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North Carolina Department of Transportation
Statewide Planning Branch
Small Urban Planning Unit

Thoroughfare Plan for

NEWLAND

June, 1994

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THOROUGHFARE PLAN
FOR THE
TOWN OF NEWLAND

Prepared by the:
Statewide Planning Branch
Division of Highways
North Carolina Department of Transportation

In Cooperation with:
The Town of Newland
The Federal Highway Administration
U. S. Department of Transportation

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June, 1994

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ACKNOWLEDGMENTS

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75 copies of this document were printed at a cost of $269.25, or $3.59 per copy (GS. 143-170.1).

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Chapter 1

INTRODUCTION

This report documents the findings of a study of Newland's Thoroughfare system that began in 1992 and culminated in the mutual adoption of the Newland Thoroughfare Plan.

The primary objective of thoroughfare planning is to enable the urban street system to progressively developed to adequately service future traffic demands. The benefits of thoroughfare planning are detailed in Chapter 8.

Newland is the county seat of Avery County, in the western portion of North Carolina. The Town is centered at the intersection of NC 181 and NC 194, both major routes of the region. Avery County is bordered to the north by Watagua County, home of Boone and Appalachian State University. The area surrounding Newland is mountainous and rural, with agriculture and manufacturing as the main industries. The Town is mostly residential, with some commercial development along NC 194 and NC 181.

Several problems prompted the Town to request a thoroughfare study in June, 1992. The intersection of NC 181 and NC 194 is the most congested intersection in the county, and they wanted to improve that intersection. The Town was also concerned with through traffic on these routes. Several other areas need traffic engineering improvements.

Another important aspect of the Newland Thoroughfare Plan was the replacement of a one-way bridge on Watagua Street. Traffic bottlenecks at the bridge at peak hours. The weight limit prevents the passage of emergency vehicles. At the requests of the Town and Statewide Planning, the bridge has been placed on the Transportation Improvement Program for replacement. Construction should begin after the year 2000.

To ensure that the recommendations of the study were comprehensively considered and consistent with the desires of the local citizens, the Statewide Planning staff met several times with the Town Board of Newland. The Board reviewed ideas and provided input during the study.

Basic thoroughfare planning principles, as described in Chapter 8, were used to develop this plan. It is based on existing traffic, population, and land use data. Year 2020 average daily traffic projections were used to determine capacity deficiencies. The adopted thoroughfare plan is expected to meet the traffic demands of Newland for the planning period of 1992 - 2020. Some major highlights of the 1994 Newland Thoroughfare Plan are:

1) **NC 194 Alternate** is a bypass of downtown Newland. The construction of this facility will remove through traffic from traveling into town, and provide relief to the NC 181/NC 194 intersection.

2) **NC 194** will be over capacity in the year 2020. To improve safety and capacity, it is recommended that this roadway be widened to three lanes between Blevins Creek Road (SR 1361) to Old NC 194 (SR 1511, toward Newland). To accommodate this section, some downtown parking would need to be revised.

3) **NC 181** should be over capacity in 2020 from the city limits to Linville. It is recommended that this two lane section be widened to three lanes.

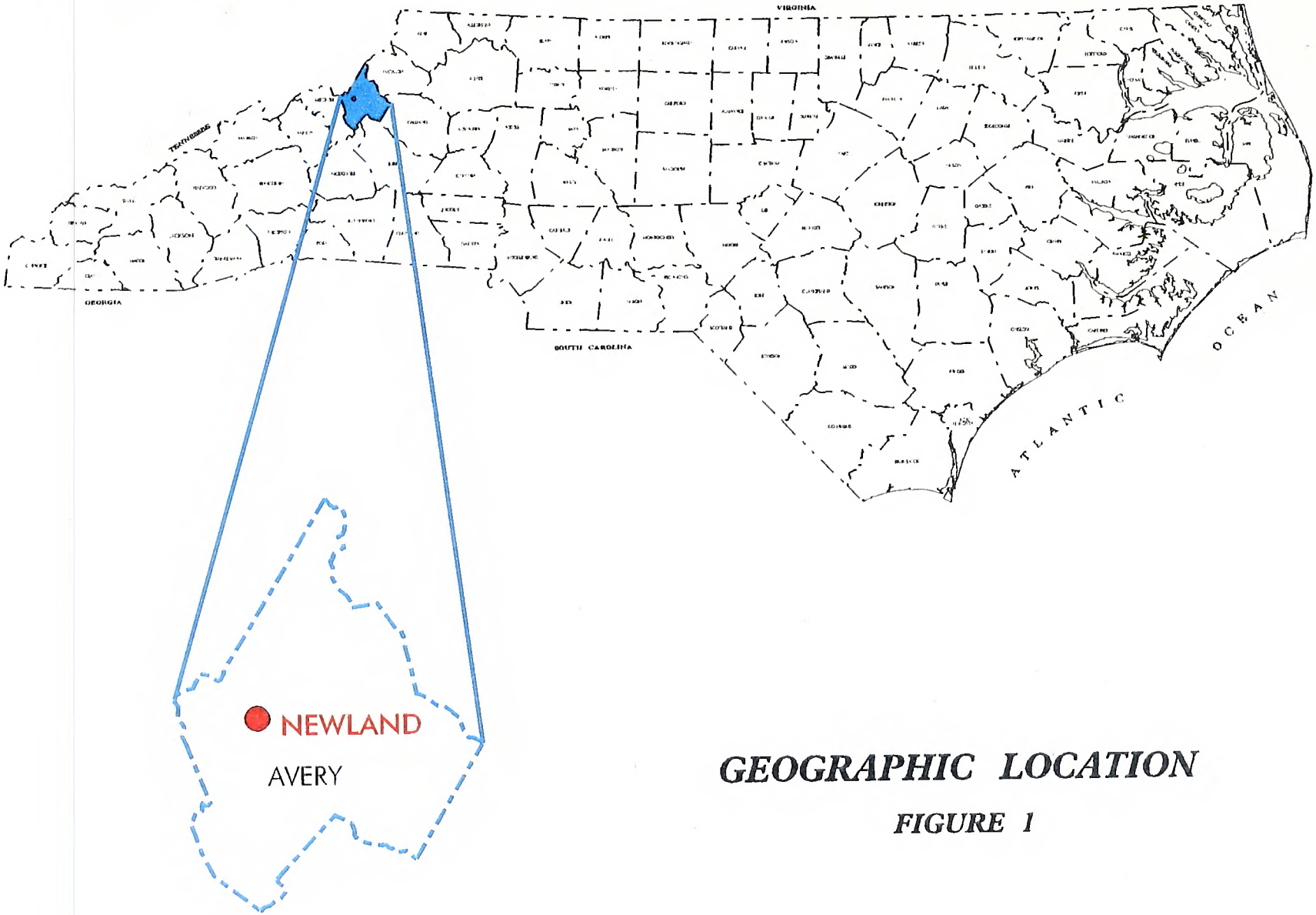
4) **Watauga Street** contains a one-way bridge near NC 181. During peak hours, traffic bottlenecks at the bridge. A two-lane bridge is recommended.

5) **Avery High School Road (SR 1370)/Old Montezuma Road (SR 1500)** is very congested in morning and afternoon peak hours. It is recommended that this route be widened to 8 m (24 feet). However, in front of the high school, it is recommended a 11 m (36 feet) section including a left turning lane.

6) A **High School Connector** is recommended to allow traffic from the two schools located on Old Montezuma Road to have access to NC 194 Alternate.

The North Carolina Department of Transportation and the Town of Newland are been jointly responsible for the proposed thoroughfare improvements. Cooperation between the state and local governmental units is of primary concern. The plan was mutually adopted by all parties and it was the responsibility of the local government bodies to implement the plan following the guidelines set forth in Chapter 4.

It should be emphasized that the recommended plan is based on anticipated growth of the urban area as indicated by current trends. Prior to construction of specific projects, a more detailed study will be required to reconsider development trends and to determine specific locations and design requirements.



GEOGRAPHIC LOCATION

FIGURE 1

LEGEND

	EXISTING	PROPOSED
MAJOR THOROUGHFARE	▬▬	▬ ▬
MINOR THOROUGHFARE	▬	▬ ▬
INTERCHANGES	●	●
GRADE SEPARATIONS	○	○

ADOPTED BY:
TOWN OF NEWLAND AUGUST 2, 1994

RECOMMENDED FOR APPROVAL BY:
STATEWIDE PLANNING BRANCH AUGUST 8, 1994

ADOPTED BY:
DEPT. OF TRANSPORTATION OCTOBER 7, 1994

PUBLIC HEARING: MAY 10, 1994 MAY 11, 1994

THOROUGHFARE PLAN

NEWLAND

AVERY COUNTY

NORTH CAROLINA

PREPARED BY THE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS-STATEWIDE PLANNING BRANCH

IN COOPERATION WITH

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

MAY 10, 1994

0 800 1600 2400 3200

SCALE IN FEET

BASE: 1988

FIGURE 2

Chapter 2

RECOMMENDED THOROUGHFARE PLAN

A thoroughfare plan study uncovers the need for new facilities, plus identifies existing and future deficiencies in the transportation system. The thoroughfare plan is a representation of the existing highway system by functional use, e.g., major thoroughfares, minor thoroughfares plus any new facilities that are needed. The planning methodology enables identification of deficiencies in the existing system, allowing compilation of a list of needed improvements.

This chapter presents an analysis and makes recommendations based on the ability of the existing street system to serve present and future travel desires as the area continues to grow. The usefulness of transportation planning is in the analysis of different highway configurations for their efficiency in serving the area. The recommended plan sets forth a system of thoroughfares to serve the anticipated traffic and land development needs for the Newland area. The need to eliminate existing and projected system deficiencies that cause traffic congestion is the primary objective of the plan.

The recommended thoroughfare plan is based on the results of a traffic forecasts that use data on traffic counts, population, housing, and employment. Each major street and highway in the planning area is analyzed to determine its ability to serve existing and future traffic demands. Proposals were developed from the analysis results.

Thoroughfare Plan Recommendations

The process of developing, testing and evaluating alternate plans involved several considerations. These included Newland's goals and objectives, identified deficiencies (see Chapter 4), environmental impacts, existing and anticipated land development, and travel services. Aerial photography, topographic mapping, field reconnaissance and discussion with local staff, officials, and interested local citizens provided additional basis for identifying and evaluating alternate alignments. The following is a list of recommendations of major and minor thoroughfares in the Newland Planing Area.

Major Thoroughfare System

The roadways serving as major thoroughfares are the primary traffic arteries of the urban area. The following roadways

are the primary traffic movers in the Newland Planning Area.

NC 194 - This two lane facility is vital to Newland's economy because it provides access to every major route within the planning area. It carries the largest traffic in the planning area, providing access from both the north and south. NC 194 provides a link between Tennessee and NC 221, which connects to South Carolina. Many trucks use this route to transport goods. Traffic along NC 194 consists mainly of through traffic with origins and destinations outside the planning area.

NC 194 is also the home to downtown Newland, where many of Newland's businesses, such as restaurants and a hotel are located. Other business are also located along NC 194 away from the downtown area, such as a grocery store and a trucking company.

The traffic data in this report indicates that this roadway is currently over capacity within the corporate limits, and nearing capacity outside the corporate limits. Without improvements, NC 194 will be severely over capacity in 30 years. To improve the safety and capacity, it is recommended that this roadway be widened to a three lane facility including a two-way left turning lane. The section recommended to be widened is between Blevins Creek Road (SR 1361, near the end of the climbing lane) and Old NC 194 (SR 1511, toward Newland).

Most of the citizens who live in Newland use some portion of NC 194 to access shopping areas. Angled parking extends through much of downtown Newland. While providing a service to the businesses and institutions, the angled parking decreases the capacity of the road. Many citizens expressed their concerns over the removal of some parking spaces with the recommendations of the three lane section in Town. At the request of Statewide Planning, the Municipal Traffic Engineering Assistance Program (MTEAP) conducted an operational analysis along NC 194. They evaluated the on-street and off-street parking between NC 181 and Old Toe River Road (SR 1157). It was recommended that angled parking should be changed to parallel between Old Toe River Road to Mitchell Street. A copy of the report is located in Appendix D.

NC 181 - This is a two-lane facility outside the corporate limits and a four-lane facility inside the corporate limits. It is Newland's major connector to the east and carries much through traffic. Newland is connected via NC 181 to Linville, Montezuma, and the Blue Ridge Parkway. NC 181 ends at NC 194 inside the Town of Newland and provides access to the downtown area, Watauga Street, and the textile plant located on Shady Street.

Traffic projections indicate that this roadway will operate over capacity from the corporate limits to Linville (the two-lane section) within the thirty year planning period. The four-lane section from NC 194 to the Town Limits will be adequate for the next thirty years. To improve safety and capacity, it is recommended that the two-lane section outside of town be widened to a three lane facility, including a two-way left turning lane.

NC 194 Alternate - Currently the best route servicing traffic between the northern and southern part of the planning area is NC 194 that goes through the Town of Newland. NC 194 is important to through traffic because it provides a link between Tennessee and NC 221, which connects to South Carolina. NC 194 is important to the Town of Newland because it serves the central business district and carries much local and school traffic. The best route to the east is NC 181. NC 181 connects Newland with Linville and the Blue Ridge Parkway. NC 181 ends at NC 194 in downtown Newland. The utilization of these routes sends high volumes of traffic through Newland. To provide a safer and quicker route in this area, it is recommended that NC 194 Alternate be constructed.

There are many benefits of NC 194 Alternate. The construction of this facility will reduce the number of passenger vehicles and remove through truck traffic traveling into Town. This facility also will reduce the congestion at the NC 181 / NC 194 intersection in Newland. The general effect of this corridor will free the local streets for use by shopping and home-to-work traffic, and will improve the economic vitality of Newland.

NC 194 Alternate should intersect NC 194 north of Newland approximately 0.35 km (0.22 mi) north of Vale Road/Summer Haven Road. The four lane, partially an access controlled corridor should run east of town and intersect with NC 194 at Avery High School Road (SR 1370). An interchange is recommended at this point. The corridor should run along Avery High School Road (SR 1370), and pass north of Avery High School. It should intersect with NC 194 south of Newland approximately 0.24 km (0.15 mi) south of Spanish Oak Road (SR 1153). Old Montezuma Road is recommended to connect with NC 194 Alternate east of the High School.

After NC 194 Alternate is constructed, it is recommended that the facility be renamed NC 194, and Existing NC 194 in Town be renamed NC 194 Business. Three other routes were studied for NC 194 Alternate. They are discussed in Chapter 7.

Minor Thoroughfare System

The roadways serving as minor thoroughfares collect traffic from local access streets in the Newland Planning Area and carry it to the major thoroughfares.

Watauga Street - This roadway connects NC 181 with the downtown area and Elk Street (SR 1342). Watauga Street contains a one-way bridge near NC 181. During peak hours, traffic becomes congested at the bridge as only one vehicle may pass at a time. Emergency vehicles cannot cross this bridge because of the low weight limit. To help relieve congestion, relieve capacity, and to provide minor relief to the NC 181 / NC 194 intersection, it is recommended that a two lane bridge be provided.

At the requests of the Town and Statewide Planning, the bridge has been placed in the Transportation Improvement Program for replacement. Construction should begin after the year 2000. The project number is B-3273.

Avery High School Road (SR 1370)/Old Montezuma Road (SR 1500) - Currently, Avery High School Road/Old Montezuma Road is the only route connecting NC 181 and NC 194 south of Town. This roadway provides access to the local high school and middle school. Otherwise, this route is mostly residential. This minor thoroughfare's road names are as follows: From NC 194 to the Middle School - Old Montezuma Road (SR 1500), from the Middle School to NC 181 - Avery High School Road (SR 1370). Any further mentions of these roads in this report refer to these sections.

During morning and afternoon peaks, this roadway and the intersections with NC 194 and NC 181 experience problems because of large volumes of school traffic. As the NC 181 / NC 194 intersection in Newland becomes more congested, more people will seek out this road as a possible through route. This will further complicate the problems of capacity and poor alignment of this route.

The Town of Newland has expressed concern over the delay on this route. Traffic projections indicate that this roadway will be sufficient for the next 30 years. However, future conditions, such as increased school and through traffic, could cause capacity problems on NC 181.

To improve safety and capacity, the following recommendations apply:

(a) The roadway along Old Montezuma Road (SR 1500)

needs to be widened to 8 m (24 ft), except in front of the schools. These areas should be widened to a three lane, 11 m (36 ft) section with a center two-way left turn lane.

(b) A High School Connector is recommended to provide alternate access to the high school and middle school from NC 194 Alternate. The connector will be located at the intersection of Avery High School Road (SR 1370) and Old Montezuma Road to the proposed NC 194 Alternate. The high school connector should discourage through traffic due to the stops and turns involved.

(c) Remove or abandon existing sections of Avery High School Road (SR 1370) not included in NC 194 Alternate.

The portion of Old Montezuma Road between Avery High School Road and Goose Hollow Road (SR 1501) is mostly unpaved, has minimal traffic, and not recommended for improvements. This portion of Old Montezuma Road is not a minor thoroughfare.

While improving the safety and efficiency of Avery High School Road/Old Montezuma Road, the recommended improvements are designed not to encourage through traffic. An increase in through traffic could jeopardize the safety of the students of the schools.

Elk Street/Hickory Nut Gap Road (SR 1342) - This narrow, winding road runs along a mountain ridge to connect Newland with Banner Elk. This route serves mostly residential traffic. The existing facility should be sufficient through the design year.

Old Toe River Road (SR 1157) - This narrow route connects Newland with Minneapolis and US 19E. Some businesses are located along this section toward Newland, but development is mainly residential. A portion of Old Toe River Road is unpaved, and is not widely used. If this section is paved it may be used more frequently. The existing cross section should be sufficient through the design year.

Spanish Oak Road (SR 1153) - This route in the southern part of the planning area connects NC 194 near Montezuma to Horney Road (SR 1117). This route is mostly residential. The existing cross section of Spanish Oak Road should be sufficient through the design year.

Intersection Improvements

The following intersections were studied for possible improvements to vehicle movements and diver safety in the Newland Planning Area.

NC 181/NC 194 - This is the most congested and heavily used intersection in Avery County. This intersection is controlled by a traffic signal. Both roads are major routes in the area. During peak hours, delay at this intersection is noticeable, and currently this intersection is over capacity.

Statewide Planning conducted an analysis on the NC 194/NC 181 intersection using future projected traffic volumes. In 2020, this intersection could have a Level of Service of F, meaning a total breakdown of effective service. The additions of turn lanes or changing of signal timing did not help bring the level of service into the D range (a somewhat acceptable level of service). Traffic queues will be unacceptable in the year 2020. Without NC 194 Alternate, traveling into downtown Newland during morning and afternoon peaks will be an unpleasant and time consuming experience.

NC 194/Vale Road - NC 193 is a two-lane facility that runs north-south. Vale Road serves a residential neighborhood. The intersection of NC 194 and Vale Road is currently unsignalized. Drivers on Vale Road turning on NC 194 have a sight distance problem due to a hill. Four of the six accidents between July 1989 and June 1992 were rear end collisions, most likely due to a motorist coming over the hill on NC 194 and encountering a slow moving, right turning vehicle off Vale Road, resulting in a rear end collision. A possible solution may be the installation of intersection ahead signs. This problem has been brought to the attention of the Division Traffic Engineer.

Other Recommendations

The peak hour times of 8:00a.m. and 3:00p.m. are critical for the major routes in Newland. It is recommended that industry (such as the textile mill) be encouraged to stagger work hours to reduce travel demand in peak periods and spread peak travel over a longer period.

Chapter 3

IMPLEMENTATION OF THE THOROUGHFARE PLAN

Implementation is one of the most important aspects of the transportation plan. Unless implementation is an integral part of this process, the effort and expense associated with developing the plan is lost. There are several tools available for use by the Town of Newland to assist in the implementation of the thoroughfare plan. They are as follows:

State-Municipal Adoption of the Thoroughfare Plan

The Town of Newland and the North Carolina Department of Transportation have mutually adopted the thoroughfare plan shown in Figure 2. The mutually approved plan may then serve as a guide for the Department of Transportation in the development of the road and highway system for the Town. The approval of the plan by the Town also enables standard road regulations and land use controls to be used effectively in the implementation of this plan. As part of the plan, the Town and Department of Transportation shall reach agreement on the responsibilities for existing and proposed streets and highways. Facilities which are designated a State responsibility will be constructed and maintained by the Division of Highways. Facilities which are designated a municipal responsibility will be constructed and maintained by the municipality.

Subdivision Controls

Subdivision regulations require every subdivider to submit to the Town Planning Commission a plan of any proposed subdivision. It also requires that subdivisions be constructed to certain standards. Through this process, it is possible to require the subdivision streets to conform to the thoroughfare plan and to reserve or protect necessary right-of-way for projected roads and highways that are to become a part of the thoroughfare plan. The construction of subdivision streets to adequate standards reduces maintenance costs and simplifies the transfer of streets to the State Highway System. Appendix C outlines the recommended subdivision design standards as they pertain to road construction.

Land Use Controls

Land use regulations are an important tool in that they regulate future land development and minimize undesirable

development along roads and highways. The land use regulatory system can improve highway safety by requiring sufficient setbacks to provide for adequate sight distances and by requiring off-street parking.

Development Reviews

Driveway access to a State-maintained street or highway is reviewed by the District Engineer's office and by the Traffic Engineering Branch of the North Carolina Department of Transportation. In addition, any development expected to generate large volumes of traffic (e.g., shopping centers, fast food restaurants, or large industries) may be comprehensively studied by staff from the Traffic Engineering Branch, Planning and Environmental Branch, and/or Roadway Design Unit of NCDOT. If done at an early stage, it is often possible to significantly improve the development's accessibility while preserving the integrity of the thoroughfare plan.

Funding Sources

Capital Improvements Program

A capital improvement program makes it easier to build a planned thoroughfare system. This capital improvement program consists of two lists of projects. The first is a list of highway projects that are designated as a municipal responsibility and are to be implemented with municipal funds. The second is a list of local projects designated as state responsibility to be included in the Transportation Improvement Program.

Transportation Improvement Program

North Carolina's Transportation Improvement Program (TIP) is a document which lists all major construction projects the Department of Transportation plans for the next seven years. Similar to local Capital Improvement Program projects, TIP projects are matched with projected funding sources. Each year when the TIP is updated, completed projects are removed, programed projects are advanced, and new projects are added.

During annual TIP public hearings, municipalities request projects to be included in the TIP. A Board of Transportation member reviews all of the project requests in a particular area of the state. Based on the technical feasibility, need, and available funding, the board member decides which projects will be included in the TIP. In addition to highway construction and widening, TIP funds are available for bridge replacement

projects, highway safety projects, public transit projects, railroad projects, and bicycle projects.

Industrial Access Funds

If an Industry wishes to develop property that does not have access to a state maintained highway and certain economic conditions are met, then funds may be made available for construction of an access road.

Small Urban Funds

Small Urban funds are annual discretionary funds made to municipalities with qualifying projects. The maximum amount is $300,000 per year per project. A town may have multiple projects. Requests for Small Urban Fund assistance should be directed to the appropriate Board of Transportation member and Division Engineer.

The North Carolina Highway Trust Fund Law

The Highway Trust Fund Law was established in 1989 as a 13.5 year plan with four major goals for North Carolina's roads and highways. These goals are:

1. To complete the remaining 2,768 km (1,716 mi) of four lane construction on the 5800 km (3,600 mi) North Carolina Intrastate System.

2. To construct a multilane connector in Asheville and portions of multilane loops in Charlotte, Durham, Greensboro, Raleigh, Wilmington, and Winston-Salem.

3. To supplement the secondary roads appropriation in order to pave, by 1999, 16,100 km (10,000 mi) of unpaved secondary roads carrying 50 or more vehicles per day, and all other unpaved secondary roads by 2006.

4. To supplement the Powell Bill Program.

In this 28-year planning period, Newland should look forward to the paving of most, if not all, of its unpaved roads on the state maintained system in the Planning Area. Also, there will be an increase in Newland's Powell Bill Funds if these newly paved roads are in the Newland Corporate Limits.

For more information on the Highway Trust Fund Law, contact the Program Development Branch of the North Carolina Department to Transportation.

Table 1

Funding Sources and Methods Recommended for Implementation of Projects

PROJECT	Funding Sources				Methods of Implementation				
	Local Funds	TIP Funds	Indust. Access	Small Urban	T-fare Plan	Subdiv. Ord.	Zoning Ord.	Future Street Lines	Development Review
1) NC 194 Altern.		X			X	X			X
2) School Connect.		X			X	X			X
3) NC 194 Widening		X			X	X	X		X
4) NC 181 Widening		X			X	X	X		X
5) Watagua St. Bridge Widening	X	X			X				

Construction Priorities and Cost Estimates

Construction priorities will vary depending on what criteria are considered and what weight is attached to the various criteria. Most people would agree that improvements to the major thoroughfare system and major traffic routes would be more important than minor thoroughfares where traffic volumes are lower. To be in the North Carolina Transportation Improvement Program, a project must show favorable benefits relative to costs and should not be prohibitively disruptive to the environment. The potential cost estimate of five Newland projects with respect to the user benefits, probability that economic development will be stimulated and environmental impacts is given in Table 4.

Reduced road user cost should result from any roadway improvement, from a simple widening to the construction of a new roadway to relieve congested or unsafe conditions. Comparisons of the existing and the proposed facilities have been made in terms of vehicle operating costs, travel time costs, and accident costs. These user benefits are computed as total dollar savings over the 28 year design period using data such as project length, base year and design year traffic volumes, traffic speed, type of facility, and volume/capacity ratio.

The impact of a project on economic development potential is shown as the probability that it will stimulate the economic development of an area by providing access to developable land and reducing transportation costs. It is a subjective estimate based on the knowledge of the proposed project, local development characteristics, and land development potential. The probability is rated on a scale from 0 (none) to 1.00 (excellent).

The environmental impact analysis considers the effect of a project on the physical, social/cultural, and economic environment. Below are listed the thirteen items that are considered when evaluating the impacts on the environment. They are: (1) air quality, (2) water resources, (3) soils and geology, (4) wildlife, (5) vegetation, (6) neighborhoods, (7) noise, (8) educational facilities, (9) churches, (10) parks and recreational facilities, (11) historic sites and landmarks, (12) public health and safety and (13) aesthetics. The summation of both positive and negative impact probabilities with respect to these factors provides a measure of the relative environmental impacts of a project.

Offsetting the benefits that would be derived from any project is the cost of its construction. A new facility, despite its high projected benefits, might prove to be unjustified due to the excessive costs involved in construction. The highway costs estimated in this report are based on the average statewide construction costs for similar

based on the average statewide construction costs for similar project types. An estimate of anticipated right-of-way costs is also included. Table 4 evaluates the proposed Newland projects with respect to user benefits, estimated costs, probability of economic development, and environmental impact. Table 2 may be used as a guideline for interpreting the "Probable Impact" values in Table 4. A detailed guide to the calculation of Cost Estimates is in Appendix E.

Table 2

Probability Estimation Guide

Subjective Evaluation	Impact Probability
Excellent - very substantial	1.00
Very good - substantial	0.75
Good - considerable	0.50
Fair - some	0.25
Poor - none	0.00

Table 3

Potential Project Cost Estimates
Investigated Projects

Project	Project Description	Construction	R/W Cost	Total
1	NC 194 Alternate	$20,349,000	$ 836,000	$21,185,000
2	School Connector	$ 343,600	$ 26,400	$ 370,000
3	NC 194 Widening	$ 1,526,700	$ 67,300	$ 1,594,000
4	NC 181 Widening	$ 456,200	$ 19,800	$ 476,000
5	Watagua Street Bridge Widening	$ 250,000	$ 1,000	$ 251,000

* = cost estimates for Newland Planning Area only

Table 4						
Benefits Evaluation for Major Projects						
Project	Benefits (1000's)	Costs (1000's)	Length (mile)	Benefits per Mile (1000's)	Economic Developmt. Potential	Eviron. Impact
1) NC 194 Alternat	$120,380	$ 21,185	3.05	$ 32,522	0.50	+0.55 -0.20
2) School Connectr	$ 864	$ 370	0.16	$ 3,088	0.00	+0.65 -0.05
3) NC 194 Widening	$ 70,843	$ 1,594	5.40	$12,823	0.20	+0.75 -0.25
4) NC 181 Widening	$ 18,752	$ 476	1.50	$12,184	0.20	+0.45 -0.00
5) Watagua Bridge	---	$ 251	0.01	---	0.00	+0.75 -0.00

Notes concerning Table 4:

The benefits of NC 194 Alternate were compared to a two-lane section of NC 194.

Watagua Street benefits could not be computed since the program does not handle the one-way bridge situation.

Chapter 4

TRAVEL DEFICIENCY ANALYSIS OF EXISTING SYSTEM

This chapter presents an analysis of the ability of the existing street system to serve the area's travel desires. Emphasis is placed not only on detecting the deficiencies, but on understanding their cause. Travel deficiencies may be localized and the result of substandard highway design, inadequate pavement width, or intersection controls. Alternately, the underlying problem may be caused by the system deficiency such as a need for a bypass, loop facility, construction or missing links, or additional radials.

Existing Travel Patterns

An indication of the adequacy of the existing major street system is a comparison of the traffic volumes with the ability of the streets to move traffic freely at a desirable speed. The ability of a street to move traffic freely, safely, and efficiently with a minimum delay is controlled primarily by the spacing of major devices utilized. Thus, the ability of a street to move traffic can be increased by restricting parking and turning movements, using proper sign and signal devices, and by the application of other traffic engineering techniques.

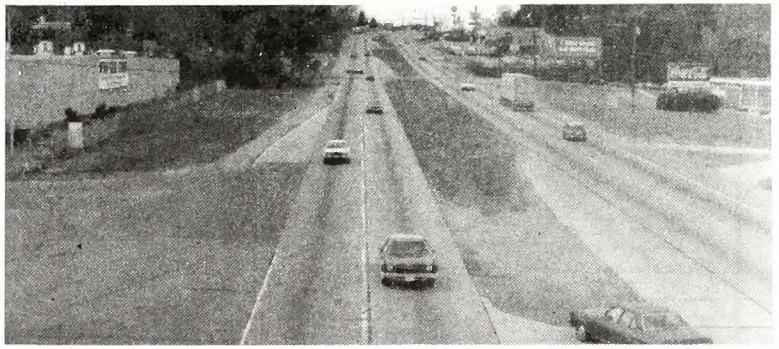
Capacity is the maximum number of vehicles that has a reasonable expectation of passing over a given section of a roadway in one direction, or in both directions, during a given period under prevailing roadway and traffic conditions.[1] The relationship of traffic volumes to the capacity of the roadway will determine **level of service** being provided. Six levels of service have been selected for analysis purposes. They are given letter designations from A to F with level-of-service (LOS) A representing the best operating conditions and level-of-service F the worst.

The six levels of service are illustrated in Figure 3, and they are defined on the following pages. The definitions are general and conceptual in nature, but may be applied to urban arterial levels of service. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them. The 1985 Highway Capacity Manual contains more detailed descriptions of the levels of service as defined for each facility type.

---

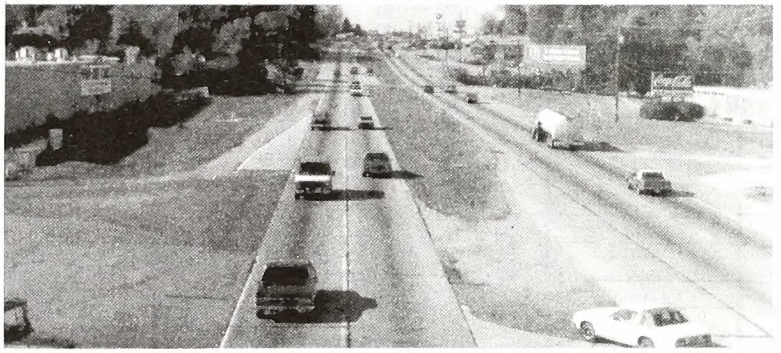
[1] Highway Capacity Manual, Special Report 209, 1-3, 1985

Table 5
Level of Service
LOS A - describes primarily free flow-operations at average travel speeds usually about 90 percent of the free-flow speed for the arterial class. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Stopped delay at signalized intersections is minimal.
LOS B - represents reasonable unimpeded operations at average travel speeds usually about 70 percent of the free-flow speed for the arterial class. The ability to maneuver within the traffic stream is only slightly restricted and stopped delays are not bothersome. Drivers are not generally subjected to appreciable tension.
LOS C - represents stable operations. However, ability to maneuver and change lanes in mid-block locations may be more restricted than in LOS B, and longer queues and/or adverse signal coordinations may contribute to lower average travel speeds of about 50 percent of the average free-flow speed for the arterial class. Motorists will experience an appreciable tension while driving.
LOS D - borders on a range on which small increases in flow may cause substantial increases in approach delay and, hence, decreases in arterial speed. Delay may be due to adverse signal progression, inappropriate signal timing, high volumes, or some combination of these. Average travel speeds are about 40 percent of free-flow speed.
LOS E - The boundary between LOS D and LOS E describes operation at **capacity**. Operations at this level are extremely unstable, because there are almost no gaps in the traffic stream. Any disruption to the traffic stream, such as a vehicle entering from a ramp, or changing lanes, requires the following vehicles to give way to admit the vehicle. This condition establishes a disruption wave which propagates through the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate any disruption. Any incident can be expected to produce a serious breakdown with extensive queuing.
LOS F - describes forced or breakdown flow. The arterial flow is at extremely low speeds - below one-third to one-quarter of the free-flow speed. Intersection congestion is likely at critical signalized locations, with high approach delays resulting. Adverse progression is frequently a contributor to this condition.



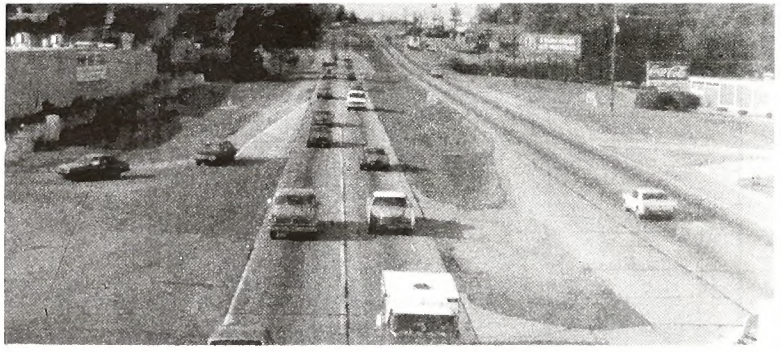
LEVEL OF SERVICE - A

LEVEL OF SERVICE - D



LEVEL OF SERVICE - B

LEVEL OF SERVICE - E



LEVEL OF SERVICE - C

LEVEL OF SERVICE - F

LEVELS OF SERVICE

FIGURE 3

Traffic Accidents

High Accident Location - Traffic accident records are of assistance in defining problem areas and often pinpoint a deficiency such as poor design, inadequate signing, ineffective parking, or poor sight distance. Accident patterns developed from analysis of accident data can lead to improvements to reduce the number of accidents.

Both the severity and number of accidents should be considered when investigating accident data. The severity of every accident is measured with a series of weighting factors developed by NCDOT's Division of Highways. In terms of these factors, a fatal or incapacitating accident is 47.7 times more severe than one involving only property damage. An accident resulting in minor injury is 11.8 times more severe than one with only property damage. Table 6 is a summary of accidents in Newland from July 1, 1989 to June 30, 1992.

The "Total" column is the total number of accidents reported within one hundred (100) feet of the intersection during the indicated period. The severity listed is the average accident severity for that location.

Table 6

Accident Summary 07/01/89 to 06/30/92

	LOCATION	TOTAL	SEVERITY
1.	NC 181 @ NC 194	11	9.23
2.	NC 194 @ Ashe	9	5.02
3.	NC 194 @ Vale	6	7.03

1992 Traffic Capacity Analysis

Capacity Deficiencies - Figure 4 depicts the base year (1992) major street system and the **ADT** (Average Daily Traffic). A comparison of the base year ADT to capacities reveals several roadways near or over practical capacity (LOS D).

The roadways near capacity are NC 194 between the east planning boundary and NC 181, and on 194 between Estotoa Street and Vale Road.

The roadways currently over capacity are NC 194 between NC 181 and Estotoa Street and also between the west planning boundary and Vale Road.

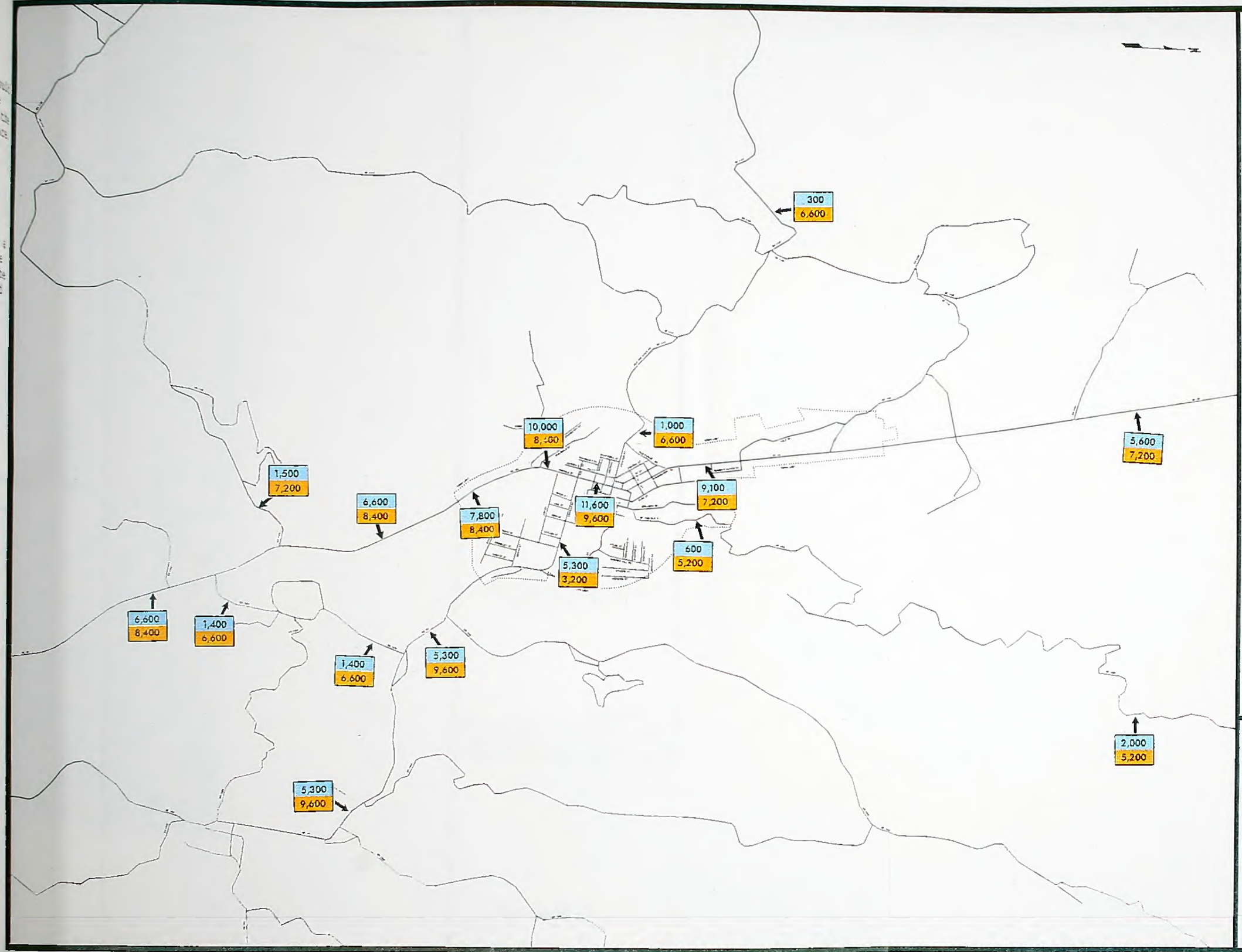
No Build Alternative

Not implementing a throughfare plan or elements of it could be called a No-Build Alternative. This means that there would be no new construction or roadway improvements to the Newland thoroughfare system except for routine maintenance. These areas could experience capacity problems:

NC 194 (entire length)
NC 181 (from Corporate limits to South Planning Boundary)

With these roads at or near capacity, the result will be a dramatic reduction in transportation quality. All of the above routes are major entrances to the Newland area. The absense of improvements will negatively impact growth and business.

Figure 5 shows the existing system assuming that no improvements are made by the design year.



BASE YEAR ADT'S VS. CAPACITY

LEGEND

XXXX BASE YEAR 1992

XXXX CAPACITY

FIGURE 4

NEWLAND

AVERY COUNTY

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BASE: 1988

EXISTING STREET SYSTEM
WITH 2020 ADT'S

FIGURE 5

NEWLAND

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BASE: 1988

Chapter 5

POPULATION, LAND USE, AND TRAFFIC

Factors Affecting Transportation

The factors of population, land use, and traffic play a vital role in determining the transportation needs of a town. Examination of these factors helps to explain historic travel patterns and lays the groundwork for thoroughfare planning.

In order to formulate an adequate year 2020 thoroughfare plan, reliable forecasts of future travel characteristics must be achieved. The factors of population, vehicle usage trends, economy, and land use play a significant role in determining the transportation needs of the area, and must be carefully analyzed. Additional items may include the effects of legal controls such as subdivision regulations and zoning ordinances, availability of public utilities and physical features of the area.

The first step in the development of the thoroughfare plan is to define the planning period and the planning area. The planning period is typically on the order of 20 years. The base year for Newland was 1992, and the year 2020 was chosen to be the endpoint of the study period (28 years). The planning area is generally the limits to which urbanization is expected to occur during the planning period.

Population

Travel is directly related to population. The volume of traffic on any given section of roadway is closely related to the size and distribution of the population that it serves. Because of this relationship, a basic step in planning a transportation system is an in-depth population study.

Given Newland's small size and the influence of tourists, much of Newland's travel originates outside the immediate area. Population trends and projections can be used as good indicators of what to expect with traffic growth in the future. Population trends for Newland and Avery County are shown in Table 7.

As shown in Table 7, a rapid increase in Newland's population is not expected to occur. However, as Boone continues to grow, and as tourism continues to increase, Newland will become more attractive to potential homeowners desiring to locate there. In addition to the tourist industry, the mountainous region of North Carolina is also an attractive area for people locating after retirement. As this trend continues, small mountain towns such as Newland will

experience an upward trend in population and travel. With the introduction of development, traffic in and around Newland will continue to grow over the next twenty-eight years.

Table 7

Population Trends and Projections

Year	Newland	Avery County	Linville Township
1940	471	13,561	3,710
1950	425	13,352	3,519
1960	564	12,009	3,525
1970	524	12,655	n/a
1980	722	14,409	4,358
1990	645	14,867	4,777
1992	722	14,893	n/a
2000	750[1]	14,956[3]	4,950[1]
2010	870[1]	14,695[3]	5,460[1]
2020	1,010[1]	14,176[3]	6,030[1]

[1] Projection based on anticipated growth
[2] Projection based on Census population data
[3] Estimate by the Office of State Planning

The most important population estimate for development of the thoroughfare plan is that of the planning area. Although the government census data is not available for the transportation planning area, other methods of estimation of population are available. The 1992 housing "windshield" survey for this study area gave a final count of 554 homes outside the Newland corporate limits. The housing count was then multiplied by the average persons per dwelling unit for Avery County (2.56) and added to the 1992 Newland population (722) to give a total planning area population of 2140. Population projections are shown in Table 8.

Table 8

Population Projections for the Newland Planning Area

Year	Planning Area
1992	2,140
2000	2,300
2010	2,600
2020	2,800

Economy and Employment

One important factor to be considered in estimating the future traffic growth of an area is its economic base. The number of employers and the employee's income or purchasing power influences how much population can be supported in the area and the number of motor vehicles that will be locally owned and operated. Generally, as the family income increases so does the number of vehicles owned, as well as the number of vehicles trips generated per day by each household. An accurate projection of the future economy of the area is essential to estimating future travel demand.

Newland is predominantly a residential community, with 46% of the residents working in agriculture. As with many rural areas in North Carolina, agriculture plays an important role in Newland's economic base. About 15% of the population is employed in manufacturing. There is also a shrub and floral industry, which includes the growth and distribution of Christmas trees. The largest employer in Newland is U.S. Textiles which employs approximately 275 people. New residential developments are being constructed within the planning area, indicating a growth in the economy of the area. These developments will increase the amount of traffic coming into Town to buy groceries and obtain services.

Land Use

Land use refers to the physical patterns of activities and functions within the city. Nearly all traffic problems in a specific area are relative to the area's land use. The amount of traffic on a particular street is very closely related to its adjacent land use. For example, a large industrial plant might be the cause of congestion during shift change hours as its workers come and go. However, during the remainder of the day little, if any, problems might occur. The spatial distribution of different types of land use (sometimes referred to as traffic generators) is the predominant determinant of when, where, and why congestion occurs. The attraction between different land uses and their association with travel varies depending on the size, type, intensity, and spatial separation of each.

For use in transportation planning, land uses are grouped into four categories: (1) Residential - all land devoted to the housing of people with the exception of hotels and motels; (2) Commercial - all land devoted to retail trade including consumer and business services and offices; (3) Industrial - all land devoted to manufacturing, storage, warehousing, and transportation of products; and (4) Public - all land devoted to social, religious, educational, cultural, and political activities. Figure 6 shows the planning area's existing land use.

Anticipated future land use is a logical extension of the present spatial distribution. Determination of where expected growth is to occur within the planning area facilitates the location of proposed thoroughfares. Areas of anticipated development and growth for Newland are:

Residential - A large amount of Newland's residential land development is located in the southern portion of the planning area.

Commercial/Retail - All commercial development, in Newland is expected to be located near the center of Town or north on NC 194.

Industrial - There is no significant industrial development expected in the planning area.

Public - There is no significant public development expected in the planning area.

The eastern and northern portions of the planning area have the largest growth expectations and are served by two major routes - NC 194 and NC 181. Hopefully, the implementation of the thoroughfare plan and NC 194 Alternate will help encourage development on the other portions of the area.

Travel Demand

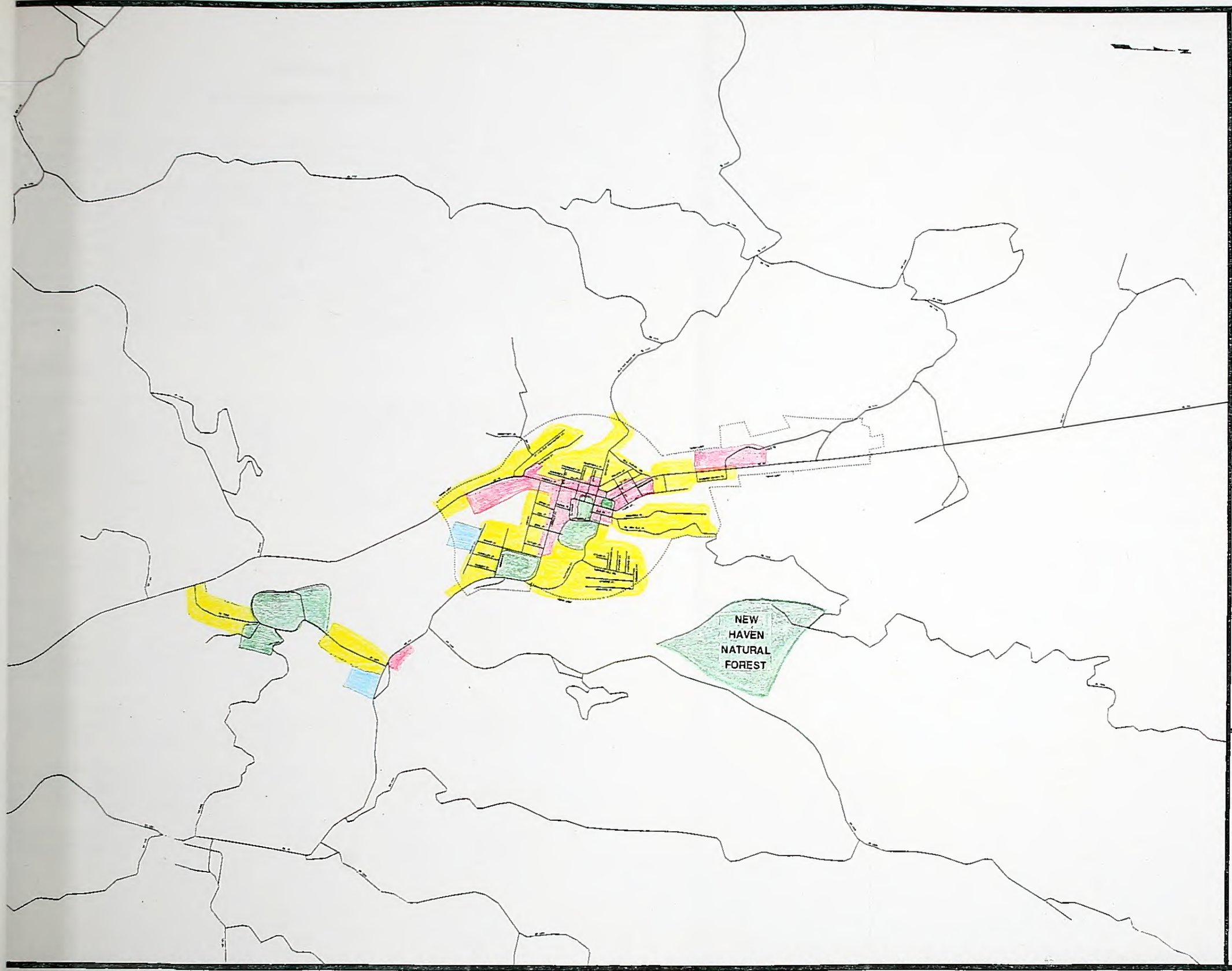
Travel demand is generally reported in average daily traffic counts. Traffic counts are taken regularly in and around Newland by the North Carolina Department of Transportation. To estimate future travel demand, traffic trends over the past twenty years were studied. A comparison of annual growth rates from 1970 to 1992 at various count locations in Newland shows the average annual growth rates ranging from 2.0% to 5.0%. The largest growth was noted on lower volume roads, where a given increase will result in a higher percentage. NC 194 experienced a growth of 4.0% to 5.0%. See Table 9 for the history of ADT volumes of NC 194 between Old Toe River Road and NC 181. Figures 4 and 5 shows existing and expected traffic volumes based on growth rates of 1.5% on minor roads, and 2.5% on major routes (NC 181 and NC 194), reflecting moderate growth. The introduction of new residential and commercial developments in the planning area will cause increases in traffic growth in those immediate areas. Eventually, this increase will level off and follow the growth pattern of the surrounding area.

Table 9

ADT for NC 194 between NC 181 and Old Toe River Rd.

Year	ADT
1970	4,500
1975	4,200
1980	7,000
1985	9,600
1989	13,700[1]
1990	12,600
1991	12,500
1992	10,000[2]

[1]This count was possibly taken during peak tourist season, therefore the average ADT is lower.
[2]This count was possibly taken in the off season or heavy winter. The actual ADT is expected to be approximately 12,500.



LAND USE

LEGEND

- RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- PUBLIC

FIGURE 6

NEWLAND

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Chapter 6

ENVIRONMENTAL CONCERNS

In the past several years, environmental considerations associated with highway construction have come to the forefront of the planning process. The legislation that dictates the necessary procedures regarding environmental impacts is the National Environmental Policy Act. Section 102 of this act requires the execution of an environmental impact statement, or EIS, for road projects that have a significant impact on the environment. Included in an EIS would be the project's impact on wetlands, water quality, historic properties, wildlife, and public lands. While this report does not cover the environmental concerns in as much detail as an EIS would, preliminary research was done on several of these factors and is included below.

Wetlands

In general terms, wetlands are lands where saturation with water is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. The single feature that most wetlands share is soil or substrate that is at least periodically saturated with or covered by water. Water creates severe physiological problems for all plants and animals except those that are adapted for life in it or in saturated soil.

Wetlands are crucial ecosystems in our environment. They help regulate and maintain the hydrology of our rivers, lakes, and streams by slowly storing and releasing flood waters. They help maintain the quality of our water by storing nutrients, reducing sediment loads, and reducing erosion. They are also critical to fish and wildlife populations. Wetlands provide an important habitat for about one third of the plant and animal species that are federally listed as threatened or endangered.

In this study, the impacts to wetlands were determined using the National Wetlands Inventory Mapping, available from the U.S. Fish and Wildlife Service.

Wetlands impacts should be avoided or minimized to the greatest extent possible while preserving the integrity of the transportation plan.

There are no major wetland impacts expected in the Newland Planning Area.

Threatened and Endangered Species

A preliminary review of the Federally Listed Threatened and Endangered Species within the Newland planning area was done to determine the effects that new corridors could have on the wildlife. These species were identified using mapping from the North Carolina Department of Environment, Health, and Natural Resources.

The Threatened and Endangered Species Act of 1973 allows the U. S. Fish and Wildlife Service to impose measures on the Department of Transportation to mitigate the environmental impacts of a road project on endangered plant and animals and critical wildlife habitats. By locating rare species in the planning stage of road construction, we are able to avoid or minimize these impacts.

Located in the northeast part of the planning area is the High Haven Registered Natural Forest Area. This natural forest contains the vaccinium macrocarpon plant, and an oak and rich cove forest, which are listed as endangered species. Although the NC 194 Alternate passes nearby, this facility will have no negative impact on the protected area. However, special care should be taken during the project planning stage of this proposal to insure the protection of this area.

Also, approximately 2.9 km (1.8 mi) west of the NC 194/NC 181 intersection near Old Toe River Road (SR 1157) is another endangered species, the carex manhartii plant. No impacts are expected in this area due to the implementation of the thoroughfare plan projects.

Detailed field investigation is recommended prior to construction of any highway project in this area.

Historic Sites

The location of historic sites in Newland was investigated to determine the possible impacts of the various projects studied. The federal government has issued guidelines requiring all State Transportation Departments to make special efforts to preserve historic sites. In addition, the State of North Carolina has issued its own guidelines for the preservation of historic sites. These two pieces of legislation are described below:

> National Historic Preservation Act - Section 106 of this act requires the Department of Transportation to identify historic properties listed in the National Register of Historic Places and properties eligible to be listed. The DOT must consider the impact of its road projects on these properties and consult with Federal Advisory Council on Historic Preservation.

NC General Statue 121-12(a) - This statue requires the DOT to identify historic properties listed on the National Register, but not necessarily those eligible to be listed. DOT must consider impacts and consult with the North Carolina Historical Commission, but it is not bound by their recommendations.

There are currently only one property in the Newland Planning Area that is listed on the National Register of Historic Places. This is the Avery County Courthouse in downtown Newland. This property will not be affected by the projects proposed on the thoroughfare plan. However, care should be taken to make certain that all historic sites and natural settings are preserved. Therefore, a closer study should be done in regard to the local historic sites prior to the construction of any proposal.

Section 4(f) Properties

The location of publicly owned land for use as public parks, recreation areas, or wildlife/waterfowl refuges in Newland was investigated to determine the possible impacts of the various projects studied. The federal government has issued guidelines requiring all State Transportation Departments to make special efforts to preserve publicly owned lands used for recreational purposes.

The Proposed NC 194 Alternate runs near a baseball field that is part of Avery County High School. This ballfield does not qualify as a Section 4(f) Public Property because it serves only school activities (4(f) Policy Paper, page 15). The ballfield has little or no walk-on activity. The area is not felt to have have local significance since other ballfields are available for public use inside the Town of Newland. If the baseball field becomes a Section 4(f) property in the future, some noise abatement measures may need to be studied.

A closer study should be done in regard to the local public properties prior to the construction of any proposal.

Chapter 7

PUBLIC INVOLVEMENT AND ALTERNATIVE PROPOSALS

The first public hearing of the Newland Thoroughfare Plan was held May 11, 1993. Many concerns were raised about the location of the proposed NC 194 Alternate, which bypasses the Town of Newland. Mike Aldridge, Newland mayor, asked that other alternatives for NC 194 Alternate be investigated. The Statewide Planning Unit investigated three additional proposals (for a total of four) that were presented at the July 6, 1993, Town Board Meeting. The Board felt that Proposal C would best meet their needs. Proposal C was the recommended corridor at the May 10, 1994 Public Hearing, which was later adopted by the Town Board.

The only differences in Proposals A, B, C, and D were the location of NC 194 Alternate and the High School Connector. Therefore, only these differences will be discussed.

All the alternative corridors accomplish the same purpose, to free the local streets for shopping and home to work traffic, and provide a much safer and quicker route for through traffic.

Proposal A

This proposal was the first recommended route and presented at the first public hearing. Although it was the shortest corridor and the lowest cost, the Town Board felt its location would not meet their needs. Figure 7 shows the location of Proposal A.

This proposal recommended that the NC 194 Alternate corridor intersect north of Newland 0.35 km (0.22 mi) north of Vale Road/Summer Haven Road. The four lane corridor would have run east of Town, and intersected with NC 194 approximately 0.32 km (0.20 mi) west of Brewer Road (SR 1346). An interchange would have been needed at this point. The corridor would have intersected with NC 194 south of Newland approximately 0.44 km (0.27 mi) north of Spanish Oak Road (SR 1153).

It was also recommended that a connector be added from the rear of the High School to NC 194 approximately 0.23 km (0.14 mi) south of Spanish Oak Road (SR 1153).

Length: 4.44 km (2.75 km)
Homes Impacted: Five
Benefits: $77,856,000
Benefits/Costs Ratio: 4.11

Costs: (includes High School Connector)

Roadway Construction	$ 3,565,000
Structures	8,231,400
Right-of-way	818,000
Engineering/Overhead	6,306,600
	$18,921,000

Proposal B

Proposal B was the same as Proposal A except the southern portion of the corridor was shifted to the southern side of two mountains. This proposal would require more earthwork than any other alternative, therefore it was not favored by the Town. Proposal B is shown in Figure 8.

NC 194 Alternate would have intersected NC 194 north of Newland approximately 0.35 km (0.22 mi) north of Vale Road/Summer Haven Road. The four lane corridor would have run east of town and intersected with NC 194 approximately 0.13 km (0.08 mi) west of Brewer Road (SR 1346). An interchange would have been needed at this point. The corridor would have intersected with NC 194 south of Newland approximately 0.44 km (0.27 mi) north of Spanish Oak Road (SR 1153).

It was also recommended that a connector be added from the rear of the High School to NC 194 approximately 0.23 km (0.14 mi) south of Spanish Oak Road (SR 1153).

Length: 4.44 km (2.75 mi)
Homes Impacted: Three
Benefits: $79,085,000
Benefits/Costs Ratio: 4.67

Costs: (Includes High School Connector)

Roadway Construction	$ 3,566,000
Structures	7,211,000
Right-of-way	525,000
Engineering/Overhead	5,649,000
	$16,951,000

Proposal C

This proposal was adopted by the Town of Newland as is shown in Figure 2 and discussed in detail in Chapter 2. The cost estimates are outlined in detail in Appendix E.

Proposal D

Several people on the Town Board suggested that Statewide Planning should further investigate NC 194 Alternate tying into Brewer Road (SR 1346). This proposal would have greatly disrupted all homes along Brewer Road. When the board discovered the impact NC 194 Alternate would have on Brewer Road, this proposal was dropped. Proposal D is shown in Figure 8.

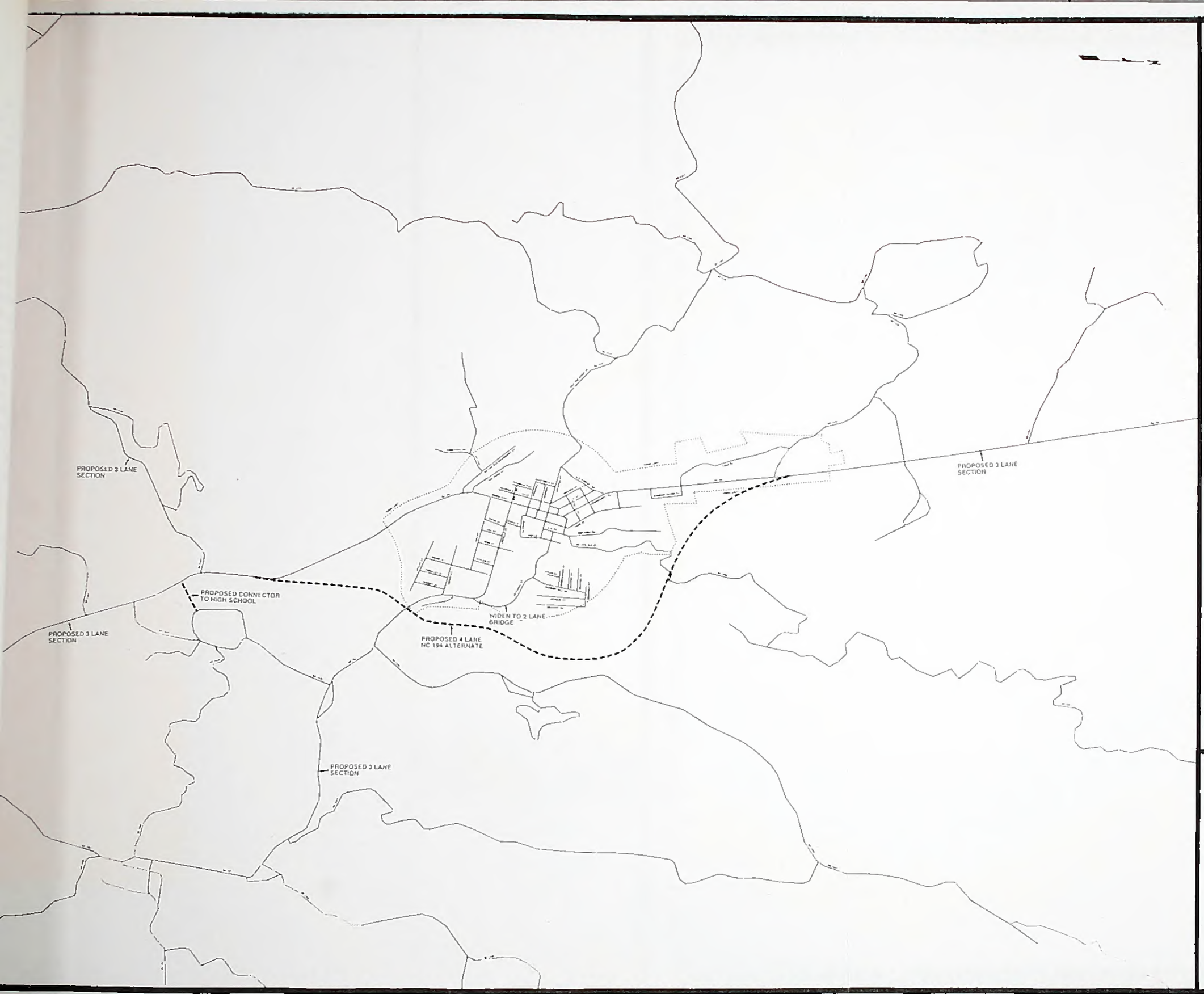
NC 194 Alternate would have intersected NC 194 north of Newland approximately 0.35 km (0.22 mi) north of Vale Road/Summer Haven Road. The four lane corridor would have run east of town partially along Brewer Road (SR 1346) and intersected with NC 194 at Avery High School Road (SR 1370) intersection. An interchange would have been needed at this point. The corridor would have run along Avery High School Road, pass north of Avery High School, and would have intersected with NC 194 south of Newland approximately 0.24 km (0.15 mi) north of Spanish Oak Road (SR 1153).

It was also recommended that a connector be added from the east of the High School to NC 194 Alternate.

Length: 4.98 km (3.09 mi)
Homes Impacted: Eleven
Benefits: $118,846,000
Benefits/Costs Ratio: 5.32

Costs: (includes High School Connector)

Roadway Construction	$ 6,320,000
Structures	7,211,000
Right of way	1,350,000
Engineering/Overhead	7,439,000
	$22,320,000



PROPOSAL A

NEWLAND

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FIGURE 7

PROPOSED 3 LANE SECTION

PROPOSED HIGH SCHOOL CONNECTOR

PROPOSED INTERCHANGE

PROPOSED 4 LANE NC 194 ALTERNATE

PROPOSED 3 LANE SECTION

PROPOSAL B

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SCALE IN FEET

FIGURE 8

BASE: 1988

PROPOSED 3 LANE SECTION

REMOVAL OF EXISTING AVERY HIGH SCHOOL RD.

PROPOSED 3 LANE SECTION

OLD MONTEZUMA RD. EXTENSION

PROPOSED INTERCHANGE

PROPOSED 2 LANE BRIDGE

PROPOSED 4 LANE NC 194 ALTERNATE

PROPOSAL D

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SCALE IN FEET

FIGURE 9

BASE: 1988

Chapter 8

THOROUGHFARE PLANNING PRINCIPLES

There are many advantages to thoroughfare planning, but the primary mission is to assure that the road system will be progressively developed to serve future travel desires. Thus, the main consideration in thoroughfare planning is to make provisions for street and highway improvements so that, when the need arises, feasible opportunities to make improvements exist.

Benefits of Thoroughfare Planning

There are two major benefits derived from thoroughfare planning. First, each road or highway can be designed to perform a specific function and provide a specific level of service. This permits savings in right-of-way, construction, and maintenance costs. It also protects residential neighborhoods and encourages stability in travel and land use patterns. Second, local officials are informed of future improvements and can incorporate them into planning and policy decisions. This will permit developers to design subdivisions in a non-conflicting manner, direct school and park officials to better locate their facilities, and minimize the damage to property values and community appearance that is sometimes associated with roadway improvements.

Thoroughfare Classification Systems

Streets perform two primary functions, traffic service and land access, which when combined, are basically incompatible. The conflict is not serious if both traffic and land service demands are low. However, when traffic volumes are high, conflicts created by uncontrolled and intensely developed abutting property lead to intolerable traffic flow friction and congestion.

The underlying concept of the thoroughfare plan is that it provides a functional system of streets that permits travel from origins to destinations with directness, ease and safety. Different streets in this system are designed and called on to perform specific functions, thus minimizing the traffic and land service conflict.

Urban Classification

In the urban thoroughfare plan, elements are classified as major thoroughfares, minor thoroughfares, or local access streets.

Major Thoroughfares are the primary traffic arteries of the urban area providing for traffic

movements within, around, and through the area.

Minor Thoroughfares are designed to collect traffic from the local access streets and carry it to the major thoroughfare system. Local Access Streets provide access to abutting property. Local streets may be further classified as either residential, commercial and/or industrial depending upon the type of land use that they serve.

Idealized Major Thoroughfare System

The coordinated system of major thoroughfares that is most adaptable to the desired lines of travel within an urban area and that is reflected in most urban area thoroughfare plans is the radial-loop system. The radial-loop system includes radials, crosstowns, loops, and bypasses (Figure 10).

Radial streets provide for traffic movement between points located on the outskirts of the city and the central area. This is a major traffic movement in most cities, and the economic strength of the central business district depends upon the adequacy of this type of thoroughfare.

If all radial streets crossed in the central area, an intolerable congestion problem would result. To avoid this problem, it is very important to have a system of crosstown streets that form a loop around the central business district. This system allows traffic moving from origins on one side of the central area to destinations on the other side to follow the area's border. It also allows central area traffic to circle and then enter the area near a given destination. The effect of a good crosstown system is to free the central area of crosstown traffic, thus permitting the central area to function more adequately in its role as a business or pedestrian shopping area.

Loop system streets move traffic between suburban areas of the city. Although a loop may completely encircle the city, a typical trip may be from an origin near a radial thoroughfare to a destination near another radial thoroughfare. Loop streets do not necessarily carry heavy volumes of traffic, but they function to help relieve central areas. There may be one or more loops, depending on the size of the urban area. They are generally spaced one-half mile to one mile apart, depending on the intensity of land use.

A bypass is designed to carry traffic through or around the urban area, thus providing relief to the city street system by removing traffic that has no desire to be in the city. Bypasses are usually designed to through-highway standards, with control of access. Occasionally, a bypass with low traffic volume can be designed to function as a portion of an urban loop. The general effect of bypasses is to expedite the movement of through traffic and to improve traffic conditions within the city. By freeing the local streets for

use by shopping and home-to-work traffic, bypasses tend to increase the economic vitality of the local area.

Objectives of Thoroughfare Planning

Thoroughfare planning is the process public officials use to assure the development of the most appropriate street system to meet the existing and future travel desires within the urban area.

The primary aim of a thoroughfare plan is to guide the development of the street system in a manner consistent with changing traffic demands. Through proper planning for street development, costly errors and needless expense can be averted. A thoroughfare plan will enable street improvements to be made as traffic demands increase, and help eliminate unnecessary improvements. By developing the street system to keep pace with increasing traffic demands, a maximum utilization of the system can be attained that will require a minimum amount of land for street purposes. In addition to providing for traffic needs, the thoroughfare plan should embody those details of good urban planning necessary to present a pleasing and efficient urban community. The location of present and future population, commercial and industrial enterprises, affects major street and highway locations. Conversely, the location of major streets and highways within the urban area will influence the urban development pattern.

Other objectives of a thoroughfare plan include:

- To provide for the development of an adequate major street system as land development occurs;
- To reduce travel and transportation costs;
- To reduce the cost of major street improvements to the public through the coordination of street system with private action;
- To enable private interests to plan their actions, improvements, and development with full knowledge of public intent;
- To minimize disruption and displacement of people and businesses through long range planning for major street improvements;
- To reduce environmental impacts such as air pollution, resulting from transportation; and
- To increase travel safety.

These objectives are achieved through improving both the operational efficiency of thoroughfares, and improving the system efficiency by system coordination and layout.

Operational Efficiency

A street's operational efficiency is improved by increasing the capability of the street to carry vehicular traffic and people. In terms of vehicular traffic, a street's capacity is the maximum number of vehicles that can pass a given point on a roadway during a given period under prevailing roadway and traffic conditions. Capacity is affected by the physical features of the roadway, nature of traffic, and weather.

Physical ways to improve vehicular capacity include:

Street widening - widening a street from two to four travel lanes more than doubles the capacity by providing additional maneuverability for traffic.

Intersection improvements - increasing the turning radii, adding exclusive turn lanes, and channelizing movements can improve the capacity of an existing intersection.

Improving vertical and horizontal alignment - reduces the congestion caused by slow moving vehicles.

Eliminating roadside obstacles - reduces side friction and improves a driver's field of sight.

Operational ways to improve street capacity include:

Control of access - A roadway with complete access control can often carry three times the traffic handled by a non-controlled access street with identical lane width and number.

Parking removal - Increases capacity by providing additional street width for traffic flow and reducing friction to flow caused by parking and unparking vehicles.

One-way operation - The capacity of a street can sometimes be increased 20-50%, depending upon turning movements and street width, by initiating one-way traffic operations. One-way streets also can improve traffic flow by decreasing potential traffic conflicts and simplifying traffic signal coordination.

Reversible Lanes - Reversible traffic lanes may be used to increase street capacity in situations where heavy directional flows occur during peak periods.

Signal phasing and coordination - Uncoordinated signals and poor signal phasing restrict traffic flow by creating excessive stop-and-go operation.

Altering travel demand is a third way to improve the efficiency of existing streets. Travel demand can be reduced or altered in the following ways:

Carpools - Encourage people to form carpools and vanpools for journeys to work and other trip purposes. This reduces the number of vehicles on the roadway and raises the people carrying capability of the street system.

Alternate mode - Encourage the use of alternate modes of travel such as transit and bicycles.

Work hours - Encourage industries, business, and institutions to stagger work hours or establish variable work hours for employees. This will reduce travel demand in peak periods and spread peak travel over a longer period.

Land use - Plan and encourage land use development or redevelopment in a more travel efficient manner.

System Efficiency

Another means of altering travel demand is the development of a more efficient system of streets that will better serve travel desires. A more efficient system can reduce travel distances, time, and cost. Improvements in system efficiency can be achieved through the concept of functional classification of streets and development of a coordinated major street system.

Application of Thoroughfare Planning Principles

The concepts presented in the discussion of operational efficiency, system efficiency, functional classification, and idealized major thoroughfare system are the conceptual tools available to the transportation planner in developing a thoroughfare plan. In actual practice, thoroughfare planning is done for established urban areas and is constrained by existing land use and street patterns, existing public attitudes and goals, and current expectations of future land use. Compromises must be made because of these and the many other factors that affect major street locations.

Throughout the thoroughfare planning process it is necessary from a practical viewpoint that certain basic principles be followed as closely as possible. These principles are as follows:

1. The plan should be derived from a thorough knowledge of today's travel - its component parts, and the factors that contribute to it, limit it, and modify it.

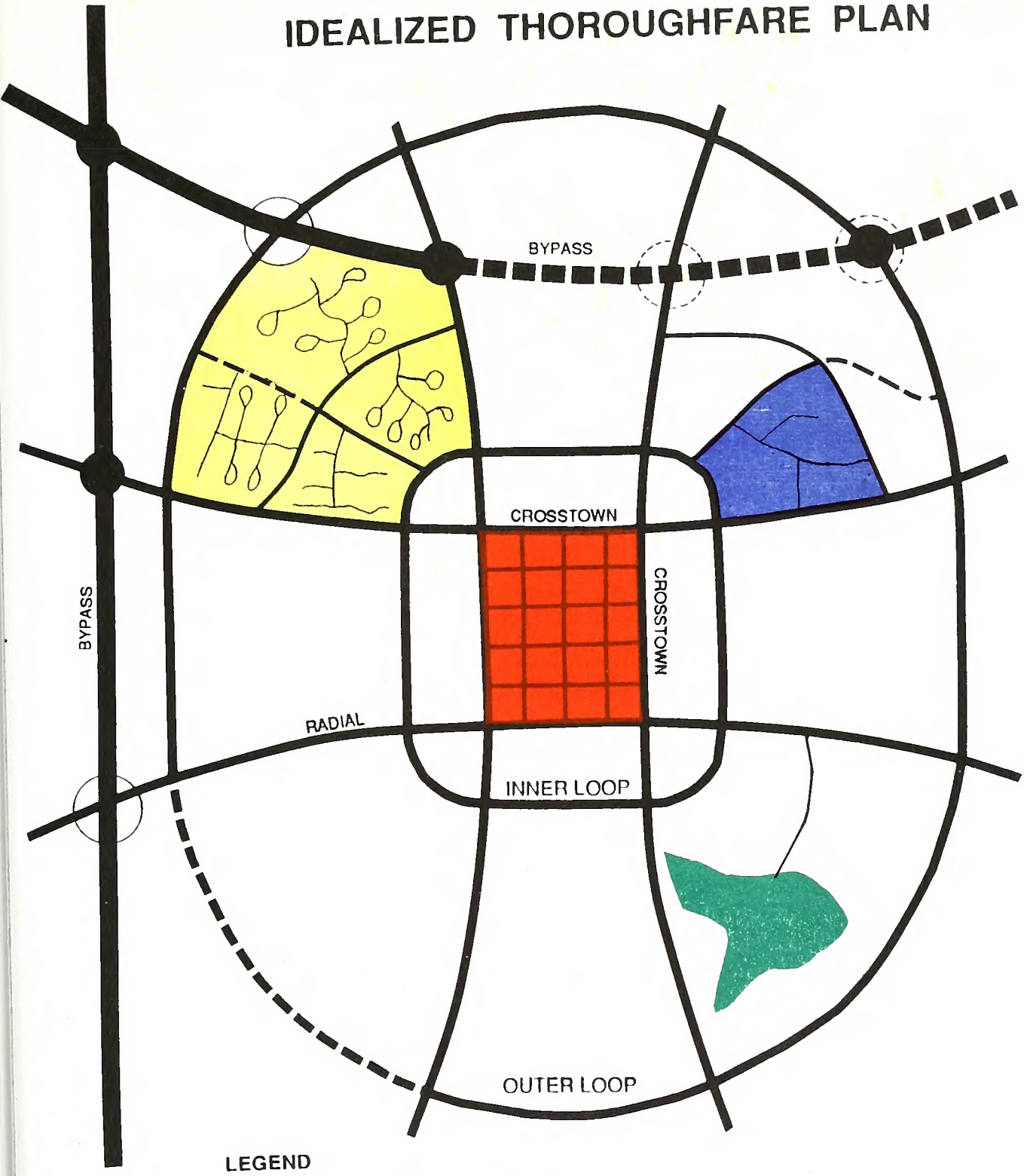
2. Traffic demands must be sufficient to warrant the designation and development of each major street. The thoroughfare plan should be designed to accommodate a large portion of major traffic movements on a few streets.

3. The plan should conform to and provide for the land development plan of the area.

4. Certain considerations must be given to urban development beyond the current planning period. Particularly in outlying or sparsely developed areas that have development potential, it is necessary to designate thoroughfares on a long-range planning basis to protect rights of way for future thoroughfare development.

5. While being consistent with the above principles and realistic in terms of travel trends, the plan must be economically feasible.

IDEALIZED THOROUGHFARE PLAN



LEGEND

	EXISTING	PROPOSED
MJOR THOROUGHFARE EEWAY		
MJOR OTHER		
MJOR THOROUGHFARE		
LCAL ROAD		
NTERCHANGE		
GADE SEPERATION		

LAND USES

- COMMERCIAL/BUSINESS
- RESIDENTIAL
- INDUSTRIAL
- PUBLIC/INSTITUTIONAL

FIGURE 10

APPENDIX A
Thoroughfare Plan Street Tabulation and Recommendations

FACILITY & SECTION	EXISTING CROSS-SECTION S.I. UNITS DIST km	RDWY m	ROW m	ENGLISH UNITS DIST MI	RDY FT	ROW FT	NUMBER of LANES	PRACTICAL CAPACITY CURRENT (FUTURE)	1992 ADTS	2020 ADTS	RECOMMENDED X - SECTION RDWAY (ULT)	ROW (ULT)
US 181												
PAB - SR 1370	3.90	7.3	21.3	2.42	24	70	2	9,600	5,300	10,600	I	ADQ
S.R. 1370 - ECL Newld	0.82	7.3	30.5	0.51	24	100	2	9,600	5,300	10,600	I	ADQ
ECL Newland - NC 194	1.10	14.6	30.5	0.68	48	100	4	32,000	5,300	10,600	ADQ	ADQ
US 194												
PAB - Old Montezuma Rd	0.97	6.7	30.5	0.60	22	100	2	8,400	6,600	13,200	I	ADQ
Old Montezuma- SR 1153	0.65	6.7	30.5	0.40	22	100	2	8,400	6,600	13,200	I	ADQ
SR 1153 - SCL Newland	1.45	6.7	30.5	0.90	22	100	2	8,400	6,600	13,200	I	ADQ
SCL Newland - SR 1156	0.56	6.7	18.3	0.35	22	60	2	8,400	7,800	15,600	I	ADQ
SCL Newland - NC 181	0.32	6.7	18.3	0.20	22	60	2	8,400	10,000	20,000	I	ADQ
NC 181 - Elk Street	0.23	7.3	18.3	0.14	24	60	2	9,600	11,600	24,300	ADQ	ADQ
Elk Street - Vale Road	1.47	6.1	18.3	0.91	20	60	2	7,200	9,100	18,000	I	ADQ
Vale Road -NCL Newland	0.37	6.1	18.3	0.23	20	60	2	7,200	9,100	18,000	I	ADQ
NCL Newland - PAB	2.89	6.1	18.3	1.79	20	60	2	7,200	5,600	11,200	I	ADQ
AVERY HIGH SCHOOL ROAD (SR 1370)												
NC 181 - SR 1500	0.95	6.1	18.3	0.59	20	60	2	6,600	1,400	2,200	Remove	-

PAB - PLANNING AREA BOUNDARY

ADQ - ADEQUATE

CL - CITY LIMIT

NOTE: CAPACITIES FOR THREE LANE SECTIONS (I) WILL BE INCREASED TO 14,000

APPENDIX A
Thoroughfare Plan Street Tabulation and Recommendations

FACILITY & SECTION	EXISTING CROSS-SECTION S.I. UNITS DIST km	RDWY m	ROW m	ENGLISH UNITS DIST MI	RDY FT	ROW FT	NUMBER of LANES	PRACTICAL CAPACITY CURRENT (FUTURE)	1992 ADTS	2020 ADTS	RECOMMENDED X - SECTION RDWAY (ULT)	ROW (ULT)
OLD MONTEZUMA ROAD (SR 1500)												
NC 194 - High School	0.97	6.1	-	0.60	20	-	2	6,600 (9,000)	1,400	2,200	K	18m
High School - SR 1370	0.24	6.1	-	0.15	20	-	2	6,600 (13,000)	1,400	2,200	I	18m
SR 1370 - SR 1501	1.10	3.1	-	1.77	20	-	2	500	50	90	ADQ	ADQ
SPANISH OAK ROAD (SR 1153)												
NC 194 - PAB	2.26	6.1	18.3	1.40	20	60	2	7,200	1,500	2,300	ADQ	ADQ
OLD TOE RIVER ROAD (SR 1157)												
NC 194 - SR 1117	1.42	5.5	18.3	0.88	18	60	2	6,600	1,000	1,600	ADQ	ADQ
SR 1117 - PAB	1.94	5.5	18.3	0.88	18	60	2	6,600	300	500	ADQ	ADQ
ELK STREET (SR 1342)												
NC 194 - ECL Newland	1.06	4.9	-	0.66	16	-	2	5,200	600	900	ADQ	ADQ
HICKORY NUT GAP ROAD (SR 1342)												
ECL Newland - PAB	3.23	4.9	-	2.00	16	-	2	5,200	2,000	3,100	ADQ	ADQ

PAB - PLANNING AREA BOUNDARY
ADQ - ADEQUATE
CL - CITY LIMIT

APPENDIX A
Thoroughfare Plan Street Tabulation and Recommendations

FACILITY & SECTION	PROPOSED CROSS-SECTION S.I. UNITS DIST km	RDWY m	ROW m	ENGLISH UNITS DIST MI	RDY FT	ROW FT	NUMBER of LANES	PRACTICAL CAPACITY CURRENT (FUTURE)	1992 ADTS	2020 ADTS	RECOMMENDED X - SECTION RDWAY (ULT)	ROW (ULT)
NC 194 ALTERNATE												
NC 194 N - NC 194 S	4.92	14.7	30.5	3.05	48	100	4	(32,000)	--	12,000	H	31m
HIGH SCHOOL CONNECTOR												
SR 1500 - NC 194 Alt.	0.26	7.3	18.3	0.16	24	60	2	(9,600)	--	500	K	18m

PAB - PLANNING AREA BOUNDARY
ADQ - ADEQUATE
CL - CITY LIMIT

Appendix B

TYPICAL THOROUGHFARE CROSS SECTIONS

Cross section requirements for thoroughfares vary according to the desired capacity and level of service to be provided. Universal standards in the design of thoroughfares are not practical. Each street section must be individually analyzed and its cross section requirements determined on the basis of amount and type of projected traffic, existing capacity, desired level of service, and available right-of-way.

Typical cross section recommendations are shown in Figure B-3. These cross sections are typical for facilities on new location and where right-of-way constraints are not critical. For widening projects and urban projects with limited right-of-way, special cross sections should be developed that meet the needs of the project.

Recommended typical cross sections for thoroughfares were derived on the basis of projected traffic, existing capacities, desirable levels of service, and available right-of-way. The recommended typical cross sections for the thoroughfares are given in Appendix A along with other pertinent information.

On all existing and proposed major thoroughfares delineated on the thoroughfare plan, adequate right-of-way should be protected or acquired for the ultimate cross sections. Ultimate desirable cross sections for each of the thoroughfares are listed in Appendix A. Recommendations for "ultimate" cross sections are provided for (1) thoroughfares which may require widening after the current planning period; (2) for thoroughfares which are borderline adequate and accelerated traffic growth could render them deficient; and (3) for thoroughfares where an urban curb and gutter cross section may be locally desirable because of urban development or redevelopment.

Recommended design standards relating to maximum and minimum grades, minimum sight distances, maximum degree of curve and related super elevation, and other considerations for thoroughfares are given in Appendix C. This Appendix gives definitions and design standards recommended for inclusion in subdivision regulations.

Cross section "A" is typical for controlled access freeways. The 14 m (46 ft) grassed median is the minimum desirable median width, but there could be some variation from this depending upon design considerations. Right-of-way requirements would typically vary upward from 70 m (228 ft) depending upon cut and fill requirements.

Cross section "B" is typical for four lane divided highways in rural areas which may have only partial or no control of access. The minimum median width for this cross section is 14 m (46 ft), but a wider median is desirable. Design requirements for slopes and drainage would be similar to cross section "A", but there may be some variation from this depending upon right-of-way constraints.

Cross section "C", seven lane urban, should not be used for new projects. When the conditions warrant six lanes, cross section "E" should be recommended. Cross section "C" should be used only in special situations such as when widening from a five lane section and right-of-way is limited. Even in these situations, consideration should be given to converting the center turn lane to a median so that cross section "E" is the final cross section.

Cross section "D", five lane urban, is typical for major thoroughfares where frequent left turns are anticipated as a result of abutting development or frequent street intersections.

Cross sections "E" and "F" are used on major thoroughfares where left turns and intersecting streets are not as frequent. Left turns would be restricted to a few selected intersections. The 4.8 m (16 ft) median is the minimum recommended for an urban boulevard type cross section. In most instances, monolithic construction should be utilized due to greater cost effectiveness, ease and speed of placement, and reduced future maintenance requirements. In special cases, grassed or landscaped medians may be used in urban areas. However, these types of medians result in greatly increased maintenance costs and an increased danger to maintenance personnel. Non-monolithic medians should only be recommended when the above concerns are addressed.

Cross section "G" is recommended for urban boulevards or parkways to enhance the urban environment and to improve the compatibility of major thoroughfares with residential areas. A minimum median width of 7.3 m (24 ft) is recommended with 9.1 m (30 ft) being desirable.

Typical cross section "H" is recommended for major thoroughfares where projected travel indicates a need for four travel lanes but traffic is not excessively high, left turning movements are light, and right-of-way is restricted. An additional left turn lane would probably be required at major intersections. This cross section should be used only if the above criteria is met. If right-of-way is not restricted, future strip development could take place and the inner lanes could become de facto left turn lanes.

In urban environments, thoroughfares which are proposed to function as one-way traffic carriers would typically require

cross section "I". Cross sections "J" and "K" are usually recommended for urban minor thoroughfares since these facilities usually serve both land service and traffic service functions. Cross section "J" would be used on those minor thoroughfares where parking on both sides is needed as a result of more intense development.

Cross section "L" is used in rural areas or for staged construction of a wider multi-lane cross section. On some thoroughfares, projected traffic volumes may indicate that two travel lanes will adequately serve travel for a considerable period of time. For areas that are growing and future widening will be necessary, the full right-of-way of 30 m (100 ft) should be required. In some instances, local ordinances may not allow the full 30 m (100 ft). In those cases, 21 m (70 ft) should be preserved with the understanding that the full 30 m (100 ft) will be preserved by use of building setbacks and future street line ordinances.

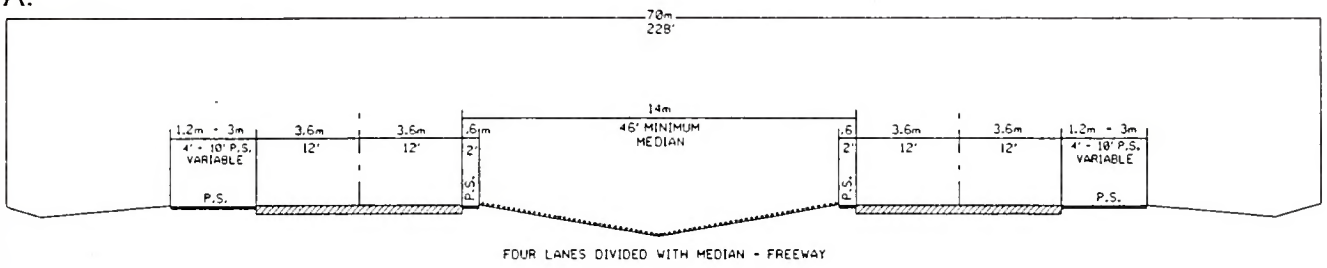
The urban curb and gutter cross sections all illustrate the sidewalk adjacent to the curb with a buffer or utility strip between the sidewalk and the minimum right-of-way line. This permits adequate setback for utility poles. If it is desired to move the sidewalk farther away from the street to provide additional separation for pedestrians or for aesthetic reasons, additional right-of-way must be provided to insure adequate setback for utility poles.

The right-of-ways shown for the typical cross sections are the minimum rights-of-way required to contain the street, sidewalks, utilities, and drainage facilities. Cut and fill requirements may require either additional right-of-way or construction easements. Obtaining construction easements is becoming the more common practice for urban thoroughfare construction.

If there is sufficient bicycle travel along the thoroughfare to justify a bicycle lane or bikeway, additional right-of-way may be required to contain the bicycle facilities. The North Carolina Bicycle Facilities Planning and Design Guidelines should be consulted for design standards for bicycle facilities. Cross sections O, P, and Q are typically used to accommodate bicycle travel.

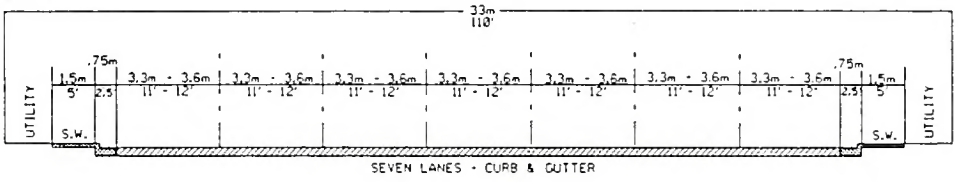
TYPICAL THOROUGHFARE CROSS SECTIONS

A.



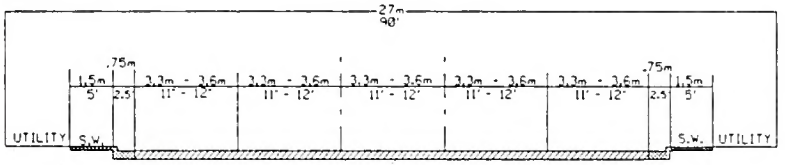
FOUR LANES DIVIDED WITH MEDIAN - FREEWAY

B.



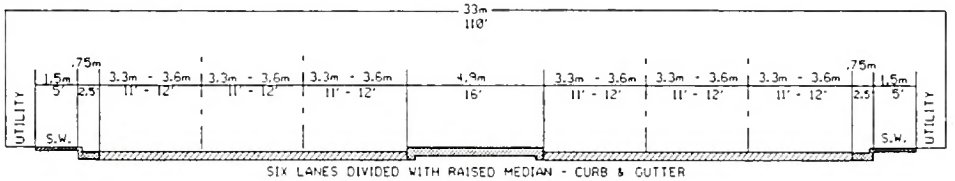
SEVEN LANES - CURB & GUTTER

C.



FIVE LANES - CURB & GUTTER

D.

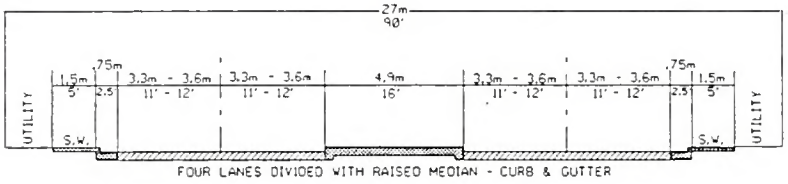


SIX LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

FIGURE 11

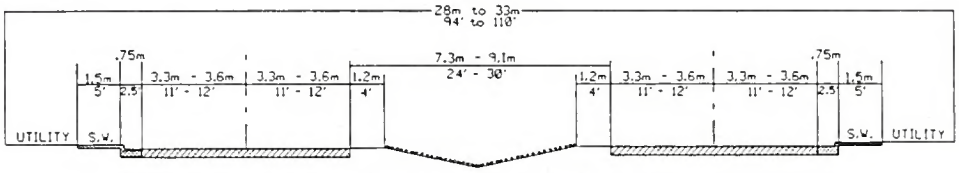
TYPICAL THOROUGHFARE CROSS SECTIONS

E.



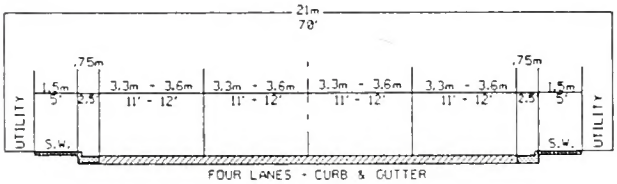
FOUR LANES DIVIDED WITH RAISED MEDIAN - CURB & GUTTER

F.



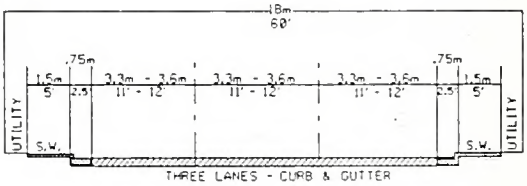
FOUR LANES DIVIDED - BOULEVARD
GRASS MEDIAN

G.



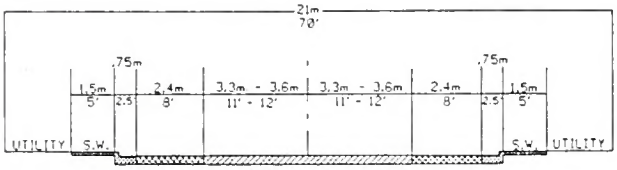
FOUR LANES - CURB & GUTTER

H.



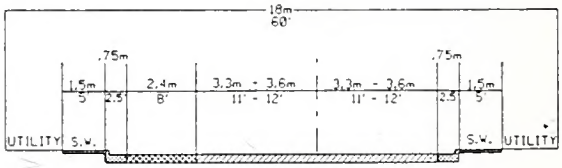
THREE LANES - CURB & GUTTER

I.



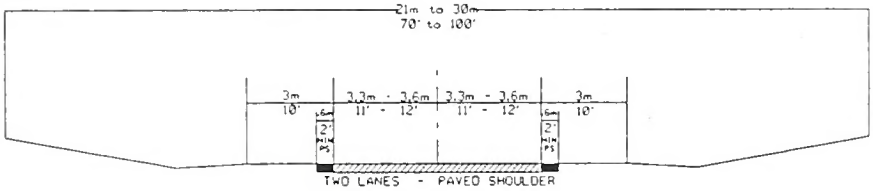
TWO LANES - CURB & GUTTER
PARKING ON EACH SIDE

J.



TWO LANES - CURB & GUTTER
PARKING ON ONE SIDE

K.



TWO LANES - PAVED SHOULDER

Appendix C

RECOMMENDED SUBDIVISION ORDINANCES

DEFINITIONS

I. Streets and Roads

A. Rural Roads

1. Principal Arterial - A rural link in a highway system serving travel, and having characteristics indicative of substantial statewide or interstate travel and existing solely to serve traffic. This network would consist of Interstate routes and other routes designated as principal arterials.

2. Minor Arterial - A rural roadway joining cities and larger towns and providing intra-state and inter-county service at relatively high overall travel speeds with minimum inter-ference to through movement.

3. Major Collector - A road which serves major intra-county travel corridors and traffic generators and provides access to the Arterial system.

4. Minor Collector - A road which provides service to small local communities and traffic generators and provides access to the Major Collector system.

5. Local Road - A road which serves primarily to provide access to adjacent land, over relatively short distances.

B. Urban Streets

1. Major Thoroughfares - Major thoroughfares consist of Inter-state, other freeway, expressway, or parkway roads, and major streets that provide for the expeditious movement of high volumes of traffic within and through urban areas.

2. Minor Thoroughfares - Minor thoroughfares perform the function of collecting traffic from local access streets and carrying it to the major thoroughfare system. Minor thoroughfares may be used to supplement the major thorough-fare system by facilitating minor through-traffic movements and may also serve abutting property.

3. Local Street - A local street is any street not on a higher order urban system and serves primarily to provide direct access to abutting land.

C. Specific Type Rural or Urban Streets

1. Freeway, expressway, or parkway - Divided multilane road-ways designed to carry large volumes of traffic at high speeds. A freeway provides for continuous flow of vehicles with no direct access to abutting property and with access to selected crossroads only by way of interchanges. An expressway is a facility with full or partial control of access and generally with grade separations at major inter-sections. A parkway is for non-commercial traffic, with full or partial control of access.

2. Residential Collector Street - A local street which serves as a connector street between local residential streets and the thoroughfare system. Residential collector streets typically collect traffic from 100 to 400 dwelling units.

3. Local Residential Street - Cul-de-sacs, loop streets less than 750 meters in length, or streets less than one and a half kilometers in length that do not connect thoroughfares, or serve major traffic generators, and do not collect traffic from more than 100 dwelling units.

4. Cul-de-sac - A short street having only one end open to traffic and the other end being permanently terminated and a vehicular turn-around provided.

5. Frontage Road - A road that is parallel to a partial or full access controlled facility and provides access to adjacent land.

6. Alley - A strip of land, owned publicly or privately, set aside primarily for vehicular service access to the back side of properties otherwise abutting on a street.

II. Property

A. Building Setback Line - A line parallel to the street in front of which no structure shall be erected.

B. Easement - A grant by the property owner for use by the public, a corporation, or person(s), of a strip of land for a specific purpose.

C. Lot - A portion of a subdivision, or any other parcel of land, which is intended as a unit for transfer of ownership or for development or both. The word "lot" includes the words "plat" and "parcel".

III. Subdivision

A. Subdivider - Any person, firm, corporation or official agent thereof, who subdivides of develops any land deemed to be a subdivision.

B. Subdivision - All divisions of a tract or parcel of land into two or more lots, building sites, or other divisions for the purpose, immediate or future, of sale or building development and all divisions of land involving the dedication of a new street or change in existing streets; provided, however, that the following shall not be included within this definition nor subject to these regulations: (1) the combination or re-combination of portions of previously platted lots where the total number of lots is not increased and the resultant lots are equal to or exceed the standards contained herein; (2) the division of land into parcels greater than four hectares where no street right-of-way dedication is involved, (3) the public acquisition, by purchase, of strips of land for the widening or the opening of streets; (4) the division of a tract in single ownership whose entire area is no greater than 0.8 hectares into not more than three lots, where no street right-of-way dedication is involved and where the resultant lots are equal to or exceed the standards contained herein.

C. Dedication - A gift, by the owner, of his property to another party without any consideration being given for the transfer. The dedication is made by written instrument and is completed with an acceptance.

D. Reservation - Reservation of land does not involve any trans-fer of property rights. It constitutes an obligation to keep property free from development for a stated period of time.

DESIGN STANDARDS

I. Streets and Roads

The design of all roads within the Planning Area shall be in accordance with the accepted policies of the North Carolina Department of Transportation, Division of Highways, as taken or modified from the American Association of State Highway Officials' (AASHTO) manuals.

The provision of street rights-of-way shall conform and meet the recommendations of the Thoroughfare Plan, as adopted by the municipality.

The proposed street layout shall be coordinated with

the existing street system of the surrounding area. Normally the proposed streets should be the extension of existing streets if possible.

A. Right-of-way Widths - Right-of-way (ROW) widths shall not be less than the following and shall apply except in those cases where ROW requirements have been specifically set out in the Thoroughfare Plan.

	Min. ROW
1. Rural	
a. Principle Arterial	
Freeways	105 meters
Other	60 meters
b. Minor Arterial	30 meters
c. Major Collector	30 meters
d. Minor Collector	24 meters
e. Local Road	18 meters[1]
2. Urban	
a. Major Thoroughfare other than Freeway and Expressway	27 meters
b. Minor Thoroughfare	21 meters
c. Local Street	18 meters[1]
d. Cul-de-sac	Variable[2]

The subdivider will only be required to dedicate a maximum of 30 meters of right-of-way. In cases where over 30 meters of right-of-way is desired, the subdivider will be required only to reserve the amount in excess of 30 meters. On all cases in which right-of-way is sought for a fully controlled access facility, the subdivider will only be required to make a reservation. It is strongly recommended that subdivisions provide access to properties from internal streets, and that direct property access to major thoroughfares, principle and minor arterials, and major collectors be avoided. Direct property access to minor thoroughfares is also undesirable.

A partial width right-of-way, not less than eighteen meters in width, may be dedicated when adjoining undeveloped property that is owned or controlled by the

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[1] The desirable minimum right-of-way (ROW) is 18 meters. If curb and gutter is provided, 15 meters of ROW is adequate on local residential streets.

[2] The ROW dimension will depend on radius used for vehicular turn around. Distance from edge of pavement of turn around to ROW should not be less than distance from edge of pavement to ROW on street approaching turn around.

subdivider; provided that the width of a partial dedication be such as to permit the installation of such facilities as may be necessary to serve abutting lots. When the said adjoining property is sub-divided, the remainder of the full required right-of-way shall be dedicated.

B. Street Widths - Widths for street and road classifications other than local shall be as recommended by the Thoroughfare Plan. Width of local roads and streets shall be as follows:

1. Local Residential
   Curb and Gutter section: 7.8 meters, face to face of curb
   Shoulder section: 6 meters to edge of pavement, 1.2 meters for shoulders

2. Residential Collector
   Curb and Gutter section: 10.2 meters, face to face of curb
   Shoulder section: 6 meters to edge of pavement, 1.8 meters for shoulders

C. Geometric Characteristics - The standards outlined below shall apply to all subdivision streets proposed for addition to the State Highway System or Municipal Street System. In cases where a subdivision is sought adjacent to a proposed thoroughfare corridor, the requirements of dedication and reservation discussed under Right-of-Way shall apply.

1. Design Speed - The design speed for a roadway should be a minimum of 10 km/h greater than the posted speed limit. The design speeds for subdivision type streets shall be:

DESIGN SPEEDS			
Facility Type	Design Speed km/h		
	Desirable	Minimum	
		Level	Rolling
RURAL			
Minor Collector Roads	100	80	70
Local roads including Residential Collectors and Local Residential	80	80	70
URBAN			
Major Thoroughfares other than Freeway or Expressway	100	80	80
Minor Thoroughfares	100	80	70
Local Streets	70	70	50

2. Maximum and Minimum Grades

a. The maximum grades in percent shall be:

MAXIMUM VERTICAL GRADE				
Facility Type	Design Speed (km/h)	Maximum Grade (Percent) Flat	Rolling	Mountainous
RURAL				
Minor Collector Roads*	30	7	10	12
	50	7	9	10
	60	7	8	10
	90	6	7	9
	100	5	6	8
	110	4	5	6
Local roads including Residential Collectors and Local Residential Streets*	30	-	11	16
	50	7	10	14
	60	7	9	12
	90	6	8	10
	100	5	6	-
URBAN				
Major Thoroughfares other than Freeway or Expressway	50	8	9	11
	60	7	8	10
	90	6	7	9
	100	5	6	8
Minor Thoroughfares*	30	9	10	12
	50	9	9	10
	60	9	8	10
	90	7	7	9
	100	6	6	8
	110	5	5	6
Local Streets*	30	-	12	17
	50	8	11	15
	60	8	10	13
	90	7	9	11
	100	6	7	-

b. Minimum grade should not be less than 0.5% .

c. Grades for 30 meters each way from intersections (measured from edge of pavement) should not exceed 5%.

* For streets and roads with projected annual average daily traffic less than 250 or short grades less than 150 meters long, grades may be 2% steeper than the values in the above table.

3. Minimum Sight Distance - In the interest of public safety, no less than the minimum sight distance applicable shall be provided. Vertical curves that connect each change in grade shall be provided and calculated using the following parameters:

SIGHT DISTANCE					
Design Speed (km/h)	30	50	60	90	100
Stopping Sight Distance					
Minimum (meters)	30	60	80	140	160
Desirable Minimum (meters)	30	70	90	170	210
Minimum K* Value for:					
Crest curve	3	10	18	71	105
Sag curve	4	12	18	40	51

(General practice calls for vertical curves to be multiples of 10 meters. Calculated lengths shall be rounded up in each case.)

4. The "Superelevation Table" shown below and continued on the next page shows the minimum radius and the related maximum superelevation for design speeds. The maximum rate of roadway superelevation (e) for rural roads with no curb and gutter is 0.08. The maximum rate of superelevation for urban streets with curb and gutter is 0.06, with 0.04 being desirable.

SUPERELEVATION TABLE		
Design Speed (km/h)	Maximum e	Minimum Radius (meters)
50	0.04	100
60	0.04	150
90	0.04	375
100	0.04	490

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* K is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in meters of the vertical curve which will provide the desired sight distance. Sight distance provided for stopped vehicles at intersections should be in accordance with "A Policy on Geometric Design of Highways and Streets, 1990".

SUPERELEVATION TABLE continued		
Design Speed (km/h)	Maximum e	Minimum Radius (meters)
50	0.06	90
60	0.06	135
90	0.06	335
100	0.06	435
50	0.08	80
60	0.08	125
90	0.08	305
100	0.08	395

e = rate of roadway superelevation, meter per meter

D. Intersections

1. Streets shall be laid out so as to intersect as nearly as possible at right angles, and no street should intersect any other street at an angle less than sixty-five (65) degrees.

2. Property lines at intersections should be set so that the distance from the edge of pavement, of the street turnout, to the property line will be at least as great as the distance from the edge of pavement to the property line along the intersecting streets. This property line can be established as a radius or as a sight triangle. Greater offsets from the edge of pavement to the property lines will be required, if necessary, to provide sight distance for the stopped vehicle on the side street.

3. Off-set intersections are to be avoided. Intersections which cannot be aligned should be separated by a minimum length of 60 meters between survey centerlines.

E. Cul-de-sacs

Cul-de-sacs shall not be more than one hundred and fifty (150) meters in length. The distance from the edge of pavement on the vehicular turn around to the right-of-way line should not be less than the distance from the edge of pavement to right-of-way line on the street approaching the turn around. Cul-de-sacs should not be used to avoid connection with an existing street or to avoid the extension of an important street.

F. Alleys

1. Alleys shall be required to serve lots used for commercial and industrial purposes except that this requirement may be waived where other definite and assured provisions are made for service access. Alleys shall not be provided in residential subdivisions unless necessitated by unusual circumstances.

2. The width of an alley shall be at least six (6) meters.

3. Deadend alleys shall be avoided where possible, but if unavoidable, shall be provided with adequate turn around facilities at the deadend as may be required by the Planning Board.

G. Permits For Connection To State Roads

An approved permit is required for connection to any existing state system road. This permit is required prior to any construction on the street or road. The application is available at the office of the District Engineer of the Division of Highways.

H. Offsets To Utility Poles

Poles for overhead utilities should be located clear of roadway shoulders, preferably a minimum of at least 9 meters from the edge of pavement. On streets with curb and gutter, utility poles shall be set back a minimum distance of 1.8 meters from the face of curb.

I. Wheel Chair Ramps

All street curbs being constructed or reconstructed for maintenance purposes, traffic operations, repairs, correction of utilities, or altered for any reason, shall provide wheelchair ramps for the physically handicapped at intersections where both curb and gutter and sidewalks are provided and at other major points of pedestrian flow.

J. Horizontal Width on Bridge Deck

1. The clear roadway widths for new and reconstructed bridges serving 2 lane, 2 way traffic should be as follows:

   a. Shoulder section approach

      i. Under 800 ADT design year

         Minimum 8.4 meters width face to face of parapets, rails, or pavement width plus 3 meters, whichever is greater.

      ii. 800 - 2000 ADT design year

         Minimum 10.2 meters width face to face of parapets, rails, or pavement width plus 3.6 meters, whichever is greater.

      iii. Over 2000 ADT design year

         Minimum width of 12 meters, desirable width of 13.2 meters width face to face of parapets or rails.

   b. Curb and gutter approach

      i. Under 800 ADT design year

         Minimum 7.2 meters face to face of curbs.

      ii. Over 800 ADT design year

         Width of approach pavement measured face to face of curbs.

         Where curb and gutter sections are used on roadway approaches, curbs on bridges shall match the curbs on approaches in height, in width of face to face of curbs, and in crown drop. The distance from face of curb to face of parapet or rail shall be a minimum of 450 millimeters, or greater if sidewalks are required.

2. The clear roadway widths for new and reconstructed bridges having 4 or more lanes serving undivided two-way traffic should be as follows:

   a. Shoulder section approach - Width of approach pavement plus width of usable shoulders on the approach left and right. (Shoulder width 2.4 m minimum, 3 m desirable.)

   b. Curb and gutter approach - Width of approach pavement measured face to face of curbs.

CONVERSION TABLE			
English Units		S.I. Units	Abreviation
1 inch	equals	25 millimeters	(mm)
1 foot	equals	0.3 meters	(m)
1 mile	equals	1.6 kilometers	(km)
1 acre	equals	2.47 hectares	(hect)

METRIC EQUIVALENTS		
1 millimeter	equals	0.001 meters
1 kilometer	equals	1000 meters
1 hectare	equals	10,000 square meters

Appendix D

Newland Parking Study

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
P.O. BOX 25201, RALEIGH, N.C. 27611-5201

JAMES B. HUNT, JR.
GOVERNOR

SAM HUNT
SECRETARY

July 29, 1993

MEMORANDUM TO: Scott Walston
Planning Engineer, Statewide Planning

FROM: Neil Deans
Assistant Urban Project Engineer

SUBJECT: Proposed 3 lane section for NC 194 in Newland, N.C. and abbreviated parking study

The Municipal Traffic Engineering Assistance Program (MTEAP), at the request of the Statewide Planning Branch, has completed an operational analysis along Linville Street (NC 194). Concerns over the growth of projected traffic volumes in Newland and their potential effects along NC 194 have been expressed. Therefore, our analysis examined the parking between NC 181 and Old Toe River Road and evaluated the feasibility of accommodating a 3 lane roadway section with a center two-way left turn lane along NC 194.

Existing Conditions:

NC 194 is a two-lane section. The area evaluated encompasses its intersection with NC 181 north to its intersection with Old Toe River Road. Twenty-eight perpendicular on-street parking spaces are provided along the west side of NC 194 between Mitchell Street and Old Toe River Road.

Observations and Analysis:

Our field investigation included the performance of an abbreviated parking study along, and adjacent to, NC 194 for a typical weekday. Field measurements of roadway cross-sections and lane striping were also recorded. The abbreviated parking study included a survey of on-street and off-street parking along NC 194 (Figure 1). Each location was inventoried for a four hour period (9:00 a.m.-12:00 noon). The average occupancy, or number of parked vehicles, for the study period was determined to be only 39.2% of maximum occupancy. The amount of parked vehicles during the peak hour of study, from 11:00 a.m. to 12:00 noon,

was only 42.7% of capacity. These numbers are representative of all parking along the complete study area and demonstrate that the amount of parking available is sufficient to meet the parking needs of the area.

Field observations concluded that traffic queues develop along NC 194 through Newland due to the existence of left turning traffic between NC 181 and Old Toe River Road. Left turns onto Old Toe River Road from NC 194 were also found to delay traffic due to the lack of left turn lanes on NC 194. In general, where exclusive turn lanes are not provided, turning traffic causes vehicular queues which leads to increased levels of accidents, motorist's delays and traffic congestion.

Recommendations:

The MTEAP, in consultation with the Division and Area Traffic Engineers, has developed the following recommendations for the town of Newland to reduce traffic congestion and increase the overall capacity of NC 194 without widening.

- Resurface and Restripe NC 194 to accommodate a three lane section with a center two-way left turn lane.

NC 194 should be resurfaced and restriped to provide a three lane section (Figure 2). This new cross-section will allow a two-way left turn lane to be provided as well as exclusive left turn lanes at its intersections with NC 181 and Old Toe River Road. This three lane section can be accommodated by using the existing cross-section and will enhance safety by reducing left turn conflicts on NC 194. However, it will be necessary to modify the existing angle parking to parallel parking to make this change.

Exclusive left turn lanes at the intersections will improve operations and safety by reducing delays caused by left turning vehicles. Furthermore, the proposed back-to-back alignment of the left turn lanes will increase the visibility of left turning motorists which will provide additional safety benefits. Again, based on our field survey this recommendation can be easily implemented within the existing 48 feet of paved cross-section.

- Change Angle Parking to Parallel Parking Along NC 194 between Old Toe River Road to Mitchell Street.

There are currently 28 perpendicular on-street parking spaces on the western side of NC 194 between Mitchell Street and Old Toe River Road. We suggest that the current perpendicular parking spaces be restriped as parallel spaces. During our study, vehicles entering and exiting these parking spaces appeared to have difficulties. With perpendicular parking, motorists are often unable to see oncoming traffic

when backing. Thus, they are forced to back "blindly" into traffic which results in increased conflicts and accidents. Studies of parking related accident rates have shown that a change from perpendicular to parallel parking reduces parking related accidents by 19 to 63 percent.

Presently, the amount of space required for a vehicle to unpark from a perpendicular space (approximately 25 feet) requires at least one and possibly both lanes of traffic on NC 194 to stop. When this happens, traffic delays and rear-end type accidents generally increase while the available capacity of the roadway decreases. A vehicle unparking from a parallel space requires only ten feet of travel lane which greatly reduces the vehicles impact on passing traffic. Therefore, the overall operation and safety of a facility is enhanced by the modification to parallel parking.

This restriping will reduce the amount of on-street parking to 14 spaces; however, the parking analysis revealed that only 12 spaces were currently used during the parking peak hour. Therefore, even with this change to parallel spacing, the available supply of on-street parking would still be sufficient to meet the on-street parking needs of downtown businesses. In addition, other on-street parking is available nearby along Old Toe River Road.

The recommendations provided are for the use of the Statewide Planning Branch in its endeavors to develop an acceptable thoroughfare plan for the town of Newland. It is hoped, with Statewide Planning's involvement with the town, that these traffic management solutions can be applied to NC 194.

We sincerely appreciate the opportunity to assist the Statewide Planning Branch with this evaluation. Please feel free to contact the Municipal Traffic Engineering Assistance Program in the future if additional assistance is required. If you have questions on the information provided, please call (919) 733-3915.

Attachments

cc: J. M. Lynch, P.E., State Traffic Engineer
R. Canales, P.E., Congestion Management Engineer
J. R. Westmoreland, Jr., Urban Traffic Engineer
L. T. Williams, Area Traffic Engineer
W. E. Hoke, Division Engineer
P. R. Goodrich, Division Traffic Engineer
M. R. Poole, P.E., PhD., Branch Manager Statewide Planning
L. F. Huntsinger, Project Engineer, Statewide Planning

Appendix E

COST ESTIMATES FOR PROPOSED PROJECTS

This is a guide in how cost estimates are calculated for proposed thoroughfare plan projects. Because these estimates are made on projects that do not have detailed functional designs, the results are general "ballpark figures." General percentages for contingency, preliminary engineering, and overhead, and typical costs are a compilation of information from the NCDOT Design Services Unit, Right-of-Way Branch, and highway construction cost estimate methodology obtained from the Durham TCC. Estimates are given in 1994 dollars.

NC 194 Alternate (Newland Bypass)

Roadway Construction (Cross Section H)

(1)	4.92 km x $950,000/km x 1.3(Mountainous Terrain Factor)	= $ 6,076,000
	TOTAL ROADWAY COST:	$ 6,076,000

Right-of-Way Estimate

(1)	25.88 acres x $5,000/acre	= $ 129,400
(2)	6 Medium Homes x $70,000/home	= $ 420,000
(3)	Proximity Damages (Estimate)	= $ 10,000
(4)	Total Cost of 1, 2, 3	= $ 559,400
(5)	Administration/Acquisition Costs = 0.30 x (4)	= $ 168,800
(6)	Relocation Costs = 0.10 x (4)	= $ 55,900
(7)	Utility Relocation 4 crossings x $12,000/crossing	= $ 48,000
(8)	Water Sewer Rel.= 0.10 x (7)	= $ 4,800
(9)	Add Lines 4, 5, 6, 7, 8	= $ 836,000
	TOTAL RIGHT OF WAY COST:	$ 836,000

Structures Cost Estimate

(1)	Bridge = 2520 sq.m. x $540/sq.m.	= $ 1,360,800
(2)	Grade Separation	= $ 850,000
(3)	1/2 Clover Interchange	= $ 5,000,000
	TOTAL STRUCTURES COST:	$ 7,211,000

(1)	Subtotal of R/W, Struct., Road.	= $ 14,123,000
(2)	Contingency Factor = 0.20 x (1)	= $ 2,825,000
(3)	Cost Plus Contingency = (1)+(2)	= $ 16,948,000
(4)	Preliminary Eng. = 0.10 x (3)	= $ 1,695,000
(5)	Overhead Factor = 0.15 x (3)	= $ 2,542,000

ESTIMATED CONSTRUCTION COST = Add 3, 4, 5 = **$ 21,185,000**

Widening NC 194 From 2 Lanes to 3 Lanes

Roadway Widening (Cross Section I)

(1)	1.53 km x $500,000/km x 1.3(Mountainous Terrain Factor)	= $	995,000
	TOTAL ROADWAY COST:	$	995,000

Right-Of-Way

(1)	NC DOT Owns All Needed R/W	= $	0
(2)	Utility Relocation 1.53 km x $40,000/km	= $	61,200
(3)	Water/Sewer Rel. = 0.1 x (2)	= $	6,100
	TOTAL RIGHT-OF-WAY COST:	$	67,300

Structures - No structures needed		= $	0
(1)	Subtotal of R/W, Struct., Road.	= $	1,062,300
(2)	Contingency Factor = 0.20 x (1)	= $	212,500
(3)	Cost Plus Contingency = (1)+(2)	= $	1,274,800
(4)	Preliminary Eng. = 0.10 x (3)	= $	127,500
(5)	Overhead Factor = 0.15 x (3)	= $	191,200

ESTIMATED CONSTRUCTION COST = Add 3, 4, 5 = **$ 1,594,000**

Widening NC 181 From 2 Lanes to 3 Lanes

Roadway Widening (Cross Section I)

(1)	0.45 km x $500,000/km x 1.3(Mountainous Terrain Factor)	= $	297,300
	TOTAL ROADWAY COST:	$	297,300

Right-Of-Way

(1)	NC DOT Owns All Needed R/W	= $	0
(2)	Utility Relocation 0.45 km x $40,000/km	= $	18,000
(3)	Water/Sewer Rel. = 0.1 x (2)	= $	1,800
	TOTAL RIGHT-OF-WAY COST:	$	19,800

Structures - No structures needed		= $	0
(1)	Subtotal of R/W, Struct., Road.	= $	317,100
(2)	Contingency Factor = 0.20 x (1)	= $	63,400
(3)	Cost Plus Contingency = (1)+(2)	= $	380,500
(4)	Preliminary Eng. = 0.10 x (3)	= $	38,100
(5)	Overhead Factor = 0.15 x (3)	= $	57,100

ESTIMATED CONSTRUCTION COST = Add 3, 4, 5 = **$ 476,000**

High School Connector

Roadway Construction (Cross Section L)

(1)	0.26 km x $500,000/km x 1.3(Mountainous Terrain Factor)	= $	220,000
	TOTAL ROADWAY COST:	$	220,000

Right-of-Way Estimate

(1)	1.89 acres x $5,000/acre	= $	9,500
(2)	No Homes Impacted	= $	0
(3)	Proximity Damages (Estimate)	= $	0
(4)	Total Cost of 1, 2, 3	= $	9,500
(5)	Administration/Acquisition Costs = 0.30 x (4)	= $	2,800
(6)	Relocation Costs = 0.10 x (4)	= $	900
(7)	Utility Relocation Costs 1 crossing x $12,000/crossing	= $	12,000
(8)	Water Sewer Rel.= 0.10 x (7)	= $	1,200
(9)	Add Lines 4, 5, 6, 7, 8	= $	26,400
	TOTAL RIGHT OF WAY COST:	$	26,400

Structures Cost Estimate

(1)	No Structures Needed	$	0
	TOTAL STRUCTURES COST:	$	0

(1)	Subtotal of R/W, Struct., Road.	= $	246,400
(2)	Contingency Factor = 0.20 x (1)	= $	49,300
(3)	Cost Plus Contingency = (1)+(2)	= $	295,700
(4)	Preliminary Eng. = 0.10 x (3)	= $	29,600
(5)	Overhead Factor = 0.15 x (3)	= $	44,400

ESTIMATED CONSTRUCTION COST = Add 3, 4, 5 = **$ 370,000**

Watagua Street Bridge Widening

The cost estimate for this project was taken from the 1995 - 2001 Transportation Improvement Plan Cost Estimate.

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